

BUILDING STANDARDS

UNIFORM  
BUILDING CODE  
1927 Edition

PREPARED BY

International Conference  
of  
Building Officials

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by

**International Conference of Building Officials**

19 Pine Avenue  
LONG BEACH, CALIFORNIA

## **Purpose of Copyright**

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The purpose of copyrighting the Uniform Building Code was not to restrict its use but to provide a contact between the Conference and those cities using the Code, and to provide a means whereby the Code could be perpetuated, so that it might best continue to serve its purpose. It was also felt that in justice to the cities on the Pacific Coast who have so generously assisted in the development of the Code that it would not be proper to permit general use of the Code by other cities who had not assisted in its preparation.

It is the intention of the Conference to permit cities, who have assisted financially in the preparation of the Code in the past, to use the Code within their corporate limits without any charge. Other cities will be required to obtain permission from the Conference before they may use the Code and this permission will be granted on a basis similar to that on which cities have supported the uniform building code work in the past.

A system has been evolved whereby all cities using or adopting the Uniform Building Code will be kept informed of any changes which may be recommended by executive action of the Conference.

Full particulars regarding the above plans will be gladly furnished by writing J. E. Mackie, Managing Secretary, International Conference of Building Officials, 19 Pine Avenue, Long Beach, Calif.

BUILDING STANDARDS

UNIFORM  
BUILDING CODE  
1927 Edition



ADOPTED BY THE  
International Conference of Building Officials  
at the 6th Annual Meeting  
October, 1927

JANUARY 1928



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LONG BEACH, CALIFORNIA

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# **International Conference of Building Officials**

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## Dedication

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*The Uniform Building Code is dedicated to the development of better building construction and greater safety to the public, through the elimination of needless red tape, favoritism and local politics by uniformity in building laws; to the granting of full justice to all building materials on the fair basis of the true merits of each material; and to the development of a sound economic basis for the future growth of cities through unbiased and equitable dealing with structural design and fire hazards.*

# Preface

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The International Conference of Building Officials takes great pride in presenting to the public the Uniform Building Code, 1927 Edition, representing several years of preparation and the final result of many preliminary drafts which have been widely studied and commented upon.

Knowledge of the lack of uniformity existing in city and state building codes was one of the reasons for the formation of the International Conference of Building Officials in 1922. The idea grew rather slowly until the fall of 1925. At that time the Conference took very definite steps toward dividing the coast area into three districts, northern, central and southern. These districts were organized with chairmen and during the year of 1926 district meetings were held for the purpose of publicly discussing the various problems attendant upon the formulation of the proposed Uniform Building Code. Data was gathered from every source possible, preliminary outlines prepared and the Code then developed part by part.

The final preliminary draft of this Code published in September, 1926, represented the first definite accomplishment in the way of a completed code although not then complete in all details. On the basis of this draft the Conference proceeded to get comments, criticisms and suggestions and continued through the medium of further district meetings to perfect the Code.

Even in this preliminary stage of development the Code was adopted by Sacramento, Alhambra, Fontana, Redlands, Oceanside and San Bernardino in California and by Klamath Falls in Oregon. A number of other cities and organizations used this preliminary draft as a model for revisions of existing building codes or in preliminary code work.

Throughout the entire preparation of the Code the policy of hearing all opinions and then weighing them carefully was closely adhered to, with the result that the completed Code represents not only one individual's experiences or ideas but is in fact a broad, equitable and unbiased document for the safe regulation of building construction. Safe practices based upon minimum safe standards have been created to permit of the greatest economy. Continual research brings to light many vital points in the engineering design of buildings and structures and the Conference has endeavored to recognize all authentic information in the effort to be just in its recommended practices. No definite limit of valuation can be placed on human life and the Code therefore provides protection not only for ordinary use of the building but for cases of emergency when such protection is imperative.

Two printed drafts of this Code have been published previously and a number of mimeographed drafts were distributed, all in the process of development of this 1927 Edition. At each successive stage of development the Code has been subjected to critical examination by more than 60

active building officials on the Pacific Coast. Many architects, engineers and contractors have given advice from the store of information gained through years of activity in their respective fields; private and governmental research bureaus and experts have generously contributed technical data. The reports of many national committees and organizations have been incorporated in the Code because of their significance and general application, and manufacturers of building materials through the various national organizations have contributed excellent information to help in producing the Code and have generously assisted in carrying this work through to completion.

A great deal of thought was given to the logical arrangement of the details in the Code. It is divided into ten parts and these parts are further divided into chapters and sections for more ready reference. Repetition was eliminated by using direct section, chapter or part references to general details wherever those details applied to various parts of the Code.

Classification of buildings according to use or the character of the occupancy allows the application of proper safety features and construction according to the hazard inherent in a particular use or occupancy. Such details as construction, height, area, location on property, protection of openings, exits, safeguards for special hazards and separations from adjoining occupancies are found properly graded in the occupancy chapters 5 to 15, inclusive.

In order that all materials and types of construction might be treated in a thoroughly unbiased manner, a fire test basis was adopted as prepared by the American Society for Testing Materials. Materials and combinations of materials upon which authentic test data were obtainable have been tabulated in Part VIII and are applied by direct reference throughout the Code.

The Code has been criticized by some individuals and organizations because it did not serve the selfish purposes in which they were interested. The Conference has endeavored in the formulation of the Code to serve no private or selfish interest but to deal fairly with all in the effort to produce safe buildings for the greatest economy and good of the public. It is true that everyone has a different estimate of just what is best and in deciding these various issues combined in the Code it was necessary to draw upon a wide field of opinion. The result finally represented is no doubt better than any individual opinion. Wherever the Uniform Building Code can be improved it is the desire of the Conference to so improve it, for it is not and never will be perfect. Fair constructive criticism and proper guidance will make the Code better through years of use and application so that ultimately much good may result.

Appreciation is given by the Conference for the fine assistance given by many individuals and organizations in the preparation of this 1927 Edition of the Uniform Building Code. Mention should be made of the reports, research and findings of the Department of Commerce Building Code Committee, the U.S. Bureau of Standards, the Underwriters Laboratories Inc., the American Society for Testing and Materials, the National Board of Fire Underwriters, the American Engineering Standards Committee, the American Concrete Institute, the Joint Committee on Reinforced Concrete, U.S. Forest Products Laboratory, Bureau of Entomology of the U.S. Department of Agriculture, and the individual work of many members of

these organizations, all of which has contributed to make the Code better. The Conference is deeply indebted to the many national and Pacific Coast trade associations who have supported the code development from the very beginning. To the many building inspectors, engineers, architects, and contractors who assisted, the Conference is indeed grateful. Certain members of the Conference are especially to be thanked for the excellent service rendered through many hours of ceaseless labor to make the Uniform Code possible. Special recognition is given to A.C. Horner, former and original secretary to the Conference, for his initiating the real active work which commenced the preparation of the Code and instituting fundamentals which form the basis of the Uniform Building Code.

J. E. M.—January 5, 1928.

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***Editor's Note:*** To preserve its authenticity, typographical errors and other irregularities in the original 1927 printing of this code have been retained in the 1987 reprint except when their inclusion would create confusion or misinformation, such as in company names.

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**INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS  
UNIFORM BUILDING CODE**

**Ordinance No. ....**

An Ordinance regulating the erection, construction, enlargement, alteration, repair, moving, removal, demolition, conversion, occupancy, equipment, use, height, area, and maintenance of buildings and/or structures in the City of .....; providing for the issuance of permits and collection of fees therefor; declaring and establishing Fire Districts; providing penalties for the violation thereof, and repealing all ordinances and/or parts of ordinances in conflict therewith.

Be it ordained by the ..... of the  
City of ..... as follows:

**PART I**  
**ADMINISTRATIVE**  
**CHAPTER 1 — TITLE AND SCOPE**

**Sec. 101.** This Ordinance shall be known as the “1927 Edition of the International Conference of Building Officials Uniform Building Code,” may be cited as such and will be referred to in this Ordinance as “this Code.”

**Title**

**Sec. 102.** The purpose of this Code is to provide certain minimum standards, provisions and requirements for safe and stable design, methods of construction and uses of materials in buildings and/or structures hereafter erected, constructed, enlarged, altered, repaired, moved, converted to other uses or demolished and to regulate the equipment, maintenance, use and occupancy of all buildings and/or structures.

**Purpose**

The provisions of this Code shall be deemed to supplement any and all state laws of the State of ..... relating to buildings.

**Sec. 103.** New buildings and/or structures hereafter erected in the City of ..... shall conform to all requirements of this Code; and all requirements in this Code, unless specifically provided, shall apply to new buildings.

**Scope**

Additions, alterations, repairs, and changes of use or occupancy in all buildings shall comply with the requirements specified in Section 104 of this Code.

**Sec. 104.** The following specified requirements shall apply to existing buildings which for any reason whatsoever do not conform to the requirements of this Code for new buildings:

**Application  
to Existing  
Buildings**

(a) If alterations and/or repairs in excess of fifty (50) per cent of the value of an existing building are made to any existing building within any period of twelve months, the entire building shall be made to conform with the requirements given herein for new buildings; provided, however, that any existing building which for any reason whatsoever, requires repairs, at any one time, in excess of fifty (50) per cent of the value thereof, not deducting from such value any loss caused by fire or any other reason, shall be made to conform to the requirements of this Code for new buildings or shall be entirely demolished.

**Major  
Alterations  
and Repairs**

(b) If the existing use or occupancy of an existing building is changed to a use or occupancy which would not be permitted in a similar building hereafter erected, the entire building shall be made to conform with the requirements given herein for new buildings; provided, however, that if the use or occupancy of only a portion or portions of an existing building is changed and such portion or portions are segregated as specified in Section

**Changed  
Use**



503 of this Code then only such portion or portions of the building need be made to comply with said requirements; and provided, further, that the Building Inspector is hereby given authority to approve any change in the use or occupancy of any existing building within any one Group of Occupancy as specified in Part III, even though such building is not made to fully conform to the requirements of this Code, when it is obvious that such a change in the use or occupancy of the existing building will not extend or increase any existing nonconformity or hazard of the building.

**Additions**

(c) Any existing building not covered by the preceding paragraphs (a) and (b) which has its floor area or its number of stories increased or its use or occupancy changed in any way from its former or existing use or occupancy shall be provided with stairways, emergency exits and fire protection facilities as specified in this Code for buildings hereafter erected for similar uses or occupancies.

**Minor  
Alterations  
and Repairs**

(d) Every alteration or repair to any structural part or portion of an existing building shall when deemed necessary in the opinion of the Building Inspector be made to conform to the requirements of this Code for new buildings. Minor alterations, repairs and changes not covered by the preceding paragraphs (a), (b) and (c) may be made with the same materials of which the building is constructed; provided, that not more than twenty-five (25) per cent of the roof covering of any building shall be replaced in any period of twelve (12) months unless the entire roof covering is made to conform with the requirements of this Code for new buildings.

New roofing meeting the requirements of this Code may be placed over existing roofings when the existing roofing and roof framing is such as to permit the new roofing to be properly supported and securely fastened.

**Maintenance**

**Sec. 105.** The requirements contained in this Code, covering the maintenance of buildings, shall apply to all buildings and/or structures now existing or hereafter erected. All buildings and/or structures and all parts thereof shall be maintained in a safe condition, and all devices or safeguards which are required by this Code at the erection, alteration or repair of any building shall be maintained in good working order.

This section shall not be construed as permitting the removal or non-maintenance of any existing devices or safeguards unless authorized in writing by the Building Inspector.

**CHAPTER 2 — GENERAL PROVISIONS**

**Sec. 201.** No person shall erect or construct any building or structure, nor add to, enlarge, move, improve, alter, convert, extend or demolish any building or structure, or cause the same to be done, without first obtaining a building permit therefor from the Building Inspector.

**Application  
for Permit**

Any person desiring a building permit as required by this Code shall file with the Building Inspector an application therefor in writing on a blank form to be furnished for that purpose.

Every such application for a permit shall describe the land upon which the proposed building or work is to be done, either by lot, block and/or tract, or similar general description that will readily identify and definitely locate the proposed building or work.

Every such application shall show the use or occupancy of all parts of the building and such other reasonable information as may be required by the Building Inspector.

Copies of plans and specifications and a lot plan showing the location of the proposed building and of every existing building thereon, shall accompany every application for a permit, and shall be filed in duplicate with the Building Inspector; provided, however, that the Building Inspector may authorize the issuance of a permit without plans or specifications for small or unimportant work.

Plans shall be drawn to scale upon substantial paper or cloth and the essential parts shall be drawn to a scale of not less than one-eighth ( $\frac{1}{8}$ ) inch to one foot.

Plans and specifications shall be of sufficient clarity to indicate the nature and character of the work proposed and to show that the law will be complied with. Computations, strain sheets, stress diagrams and other data necessary to show the correctness of the plans, shall accompany the plans and specifications when required by the Building Inspector.

Any specifications in which general expressions are used to the effect that "work shall be done in accordance with the Building Code" or "to the satisfaction of the Building Inspector" shall be deemed imperfect and incomplete and every reference to this Code shall be to the section or subsection applicable to the material to be used or to the method of construction proposed.

All plans shall bear the name of the Architect, Structural Engineer or Designer. (See Appendix).

**Sec. 202.** The application, plans and specifications filed by an applicant for a permit shall be checked by the Building Inspector and if found to be in conformity with the requirements of this Code and all other laws or ordinances applicable thereto, the Building Inspector shall, upon receipt of the required fee, issue a permit therefor.

**Building  
Permits**

When the Building Inspector issues the permit he shall endorse in writing or stamp both sets of plans and specifications "Approved." One

such approved set of plans and specifications shall be retained by the Building Inspector as a public record, and one such approved set of plans and specifications shall be returned to the applicant, which set shall be kept on such building or work at all times during which the work authorized thereby is in progress and shall be open to inspection by public officials. Such approved plans and specifications shall not be changed, modified or altered without permission from the Building Inspector.

**Fees**

**Sec. 203.** Any person desiring a building permit shall, at the time of filing an application therefor, as provided in Sec. 201 of this Code, pay to the ..... a fee as required in this section. (See Appendix).

For a total valuation of \$50.00 or less no fee.

For a total valuation from \$50.00 to \$1,001 a \$2.00 fee.

An additional fee of \$2.00 for each additional \$1000 or fraction thereof of total valuation to and including \$15,000.

An additional fee of \$1.00 for each additional \$1000 or fraction thereof of total valuation to and including \$50,000.

An additional fee of 50¢ for each additional \$1000 or fraction thereof of total valuation exceeding \$50,000.

The City of ....., the County of ..... the State of ....., and the United States of America, shall be exempted from the paying of any fee for any building permit.

Where work for which a permit is required by this Code is started or proceeded with prior to obtaining said permit, the fees above specified shall be doubled, but the payment of such double fee shall not relieve any persons from fully complying with the requirements of this Code in the execution of the work nor from any other penalties prescribed herein.

The Building Inspector shall keep a permanent, accurate account of all fees collected and received under this Code and give the name of the persons upon whose account the same were paid, the date and amount thereof, together with the location of the building or premises to which they relate.

**Inspection  
and  
Registered  
Inspectors**

**Sec. 204.** The Building Inspector shall inspect or cause to be inspected at various intervals during the erection, construction, enlarging, alteration, repairing, moving, demolition, conversion, occupancy and underpinning all buildings and/or structures referred to in this Code and located in the City of ..... and a final inspection shall be made of every building and/or structure hereafter erected prior to the issuance of the Certificate of Occupancy as specified in Sec. 206.

No building construction, alteration, repair or demolition requiring a building permit shall be commenced until the permit holder or his agent shall have posted the building permit card in a conspicuous place on the front premises and in such position as to permit the Building Inspector to conveniently make the required entries thereon respecting inspection of the

work. This permit card shall be maintained in such position by the permit holder until the Certificate of Occupancy has been issued by the Building Inspector.

The Building Inspector upon notification from the permit holder or his agent shall make the following inspections of Type V buildings and shall either approve that portion of the construction as completed or shall notify the permit holder or this agent wherein the same fails to comply with the law.

**Foundation Inspection:** To be made after trenches are excavated and the necessary forms erected and when all materials for the foundation are delivered on the job.

**Frame Inspection:** To be made after the roof, all framing, fire-blocking and bracing is in place and all pipes, chimneys and vents are complete.

**Stucco Inspection:** To be made after all lathing and backing is in place and all plastering and stucco materials are delivered on the job, but before any stucco is applied.

**Final Inspection:** To be made after building is completed and is ready for occupancy.

No work shall be done on any part of the building and/or structure beyond the point indicated in each successive inspection without first obtaining the written approval of the Building Inspector. Such written approval shall be given only after an inspection shall have been made of each successive step in the construction as indicated by each of the above four inspections. (See Appendix).

No reinforcing steel or structural framework of any part of any building or structure shall be covered or concealed in any manner whatsoever without first obtaining the approval of the Building Inspector.

In all buildings where plaster is used for fire protection purposes the permit holder or his agent shall notify the Building Inspector after all lathing and backing is in place and all plastering materials are delivered on the job and no plaster shall be applied until the approval of the Building Inspector has been received.

Any person engaged in the erection or causing the erection of a building and/or structure, except Type V Buildings and/or structures, where the estimated cost exceeds \$20,000 shall employ a "registered inspector" properly qualified as specified in this section or shall cause his employment by the architect, structural engineer or designer of such structure; provided, that the Building Inspector may authorize the proposed construction without requiring a "registered inspector" when in his estimation such special supervision is not necessary. The Building Inspector may designate any building and/or structure as requiring a "registered inspector" when deemed necessary or where there is a complicated design or where new materials or methods of construction are intended to be used.

The "registered inspector" shall be approved by, registered with, deputized by and assigned to a particular building or structure by the Building Inspector. Such "registered inspector" shall be thoroughly qualified by

**Special  
Engineering  
Supervision**

knowledge and experience in the design and construction of the structure to which he is assigned by the Building Inspector and he shall be thoroughly familiar with the requirements of this Code applying to that building or structure and of their practical application. The Building Inspector may authorize one such "registered inspector" to supervise the construction of a limited number of buildings and/or structures provided that his service shall extend over all the important details of framing, erection and assembly and that he is able to render full engineering inspection service on each building and/or structure under his supervision and control.

Before commencing his duties the "registered inspector" in the City of ..... shall obtain a certificate of registration from the Building Inspector for which he shall pay the sum of one dollar (\$1.00), and he shall deposit with the Building Inspector a surety bond in the sum of five thousand dollars (\$5000) conditioned upon the faithful and efficient performance of his duties, said bond to be made payable to the City of ....., and to be furnished for the term of one year. The "registered inspector" shall remain constantly upon the work during the process of construction and his duties shall terminate only when a Certificate of Compliance is issued by the Building Inspector in approval and acceptance of the work on which he may be engaged as specified in Section 205.

Each such "registered inspector" shall carefully inspect all materials entering into the construction of the structure and be responsible for obtaining full information regarding the strength of materials where new or untried materials are intended for any use involving structural safety. He shall have full authority to inspect and pass upon the sufficiency of all work involving the construction of forms, bracing, shoring, needling, underpinning, mixing of concrete, protection of same, depositing of material, placing of reinforcing steel, removal of forms, the erection of structural steel, trusses and bracing, the placing of structural timbering, the erection of masonry, tile and terra cotta, and each and every item of material used in the engineering assembly or erection of the building or structure. He shall report in writing, upon the special forms furnished by the Building Department, the true details regarding the progress of the work, the condition of same, deviation, defects, delays, general character of materials, working situations, weather conditions and all and any influencing factors that affect in any manner the structural safety and strength of the building. He shall be held directly responsible for the enforcement of this Code wherever same is applicable to the structure upon which he is engaged. He shall notify the Building Inspector of any attempt to cover, conceal, patch or repair any defect in materials or workmanship before such materials have been examined by the Building Inspector or his duly authorized representative. He shall be held directly responsible for the infraction of any ruling of the Building Inspector and shall have the authority to compel the removal of defective materials or to suspend or stop work pending the rulings of the Building Inspector. He shall not be engaged in any other labor on the project upon which he is employed.

**Sec. 205.** The duties of the “registered inspector” shall terminate only when a Certificate of Compliance has been issued by the Building Inspector. Such Certificate of Compliance shall bear a statement signed by the “registered inspector” stating that the work upon the building or structure to which he has been assigned has been completed in a satisfactory manner and that the regulations of this Code affecting the structural features of such building or structure have been fully complied with. If there have been any infractions of this Code they shall be noted in this statement. The Building Inspector shall approve such Certificate of Compliance filed by the “registered inspector” if after inspection the structural features of such building or structure are found to be in accordance with the provisions of this Code. Each Certificate of Compliance shall bear the legal description of the property upon which such building or structure is located and an identifying description of the building. A duplicate of each Certificate of Compliance shall be kept on file permanently in the office of the Building Inspector.

**Certificate  
of  
Compliance**

**Sec. 206.** No building shall be occupied in any part thereof unless or until a Certificate of Occupancy has been issued by the Building Inspector. The Building Inspector shall, after an application therefor has been filed by the owner or his agent, issue a Certificate of Occupancy for such building, if after inspection it is found that such building complied with the provisions of this Code and all other requirements of law or ordinance applicable thereto. Such Certificate of Occupancy shall show the use to which the structure may be put and the maximum allowable floor loads for each floor thereof. A temporary Certificate of Occupancy may be issued by the Building Inspector for the temporary use of a portion of a building prior to the completion and occupancy of the entire building.

**Certificate  
of  
Occupancy**

**Sec. 207.** The use or occupancy of any building shall not be changed until a Certificate of Occupancy permitting the new use or occupancy is issued by the Building Inspector when the new occupancy is such as to require alterations or repairs of the building, as specified in this Code. No such Certificate of Occupancy shall be issued unless the building shall comply with the requirements of this Code as specified in Section 104.

**Change of  
Occupancy**

**CHAPTER 3 — ENFORCEMENT**

**Powers and  
Duties of  
Building  
Inspector**

**Sec. 301.** The Building Inspector is hereby authorized and directed to enforce all of the provisions of this Code and for such purpose he shall have the powers of a police officer.

The Building Inspector or his authorized representative may enter any building or premises for the purpose of inspection or to prevent violation of this Code, upon presentation of the proper credentials.

Whenever any building work is being done contrary to the provisions of this Code, or is being done in an unsafe or dangerous manner, the Building Inspector may order the work stopped by notice in writing served on any persons engaged in the doing or causing such work to be done, and any such person shall forthwith stop such work until authorized by the Building Inspector to recommence and proceed with the work.

Whenever any building or portion thereof is being used or occupied contrary to the provisions of this Code the Building Inspector shall order such use or occupancy discontinued and the building or portion thereof vacated by notice served on any person using or causing such use or occupancy to be continued and such person shall vacate such building or portion thereof within ten days after receipt of such notice, or make the building or portion thereof comply with the requirements of this Code; provided, however, that in the event of an emergency the following paragraph shall apply.

Any building or portion thereof, including buildings and/or structures in process of erection, if found to be dangerous to persons or property, or unsafe for the purpose for which it is being used, or in danger from fire due to defects in construction, or dangerous for use because of insufficient means of egress in case of fire, or which violates the provisions of this Code due to the removal, decay, deterioration or the falling off of any thing, appliance, device or requirement originally required by this Code, or which has become damaged by the elements of fire to an extent of fifty (50) per cent of its value, may be condemned by the Building Inspector. The Building Inspector may order portions of the structural frame of a building or structure to be exposed for inspection when in his opinion they are in an unsafe condition. In any of the aforesaid cases the Building Inspector shall serve notice in writing on the owner, reputed owner or person in charge of such a building or premises, setting forth what must be done to make such building safe. The person receiving such notice shall commence within forty-eight hours thereafter to make the changes, repairs or alterations set out in such notice and diligently proceed with such work or demolish the building. No such building shall be occupied or used for any purpose after the Building Inspector serves written notice of its unsafe or dangerous condition until the instructions of the Building Inspector have been complied with.

If, at the expiration of the time as set forth in the first notice, the instructions, as stated, have not been complied with, a second notice shall

be served personally upon the owner, his agent, or the person in possession, charge or control of such building or structure or part thereof, stating therein such precautionary measures as may be necessary or advisable to place such building or structure or part thereof in a safe condition. Should the necessary changes not be made within thirty days after the service of such second notice the City Council may order the Building Inspector to proceed with the work specified in such notice. A statement of the cost of such work shall be transmitted to the City Council, who shall cause the same to be paid and levied as a lien against the property. Proper service of either such notices shall be personal service upon the owner of record, if he shall be within the City of ..... If he is not in the City of ..... such service may be had upon any person accustomed to collect rents on the property in question who may be in the City of ....., and in the absence of such a person, upon the tenant of the premises. In the event such premises are vacant, and the owner is not in the City of ....., such service will be completed when the notice is sent by registered mail to the last known address of the said owner. Whenever the owner, agent or tenant is a corporation, service may be upon the President, Vice-President, Secretary or Treasurer, or in the absence of any of these, the local representatives of such corporation.

**Sec. 302.** The provisions of this Code are not intended to prevent the use of types of construction or materials offered as an alternate for the types of construction or materials required by this Code, but such alternate types of construction or materials to be given consideration shall be offered for approval as specified in this chapter.

**Alternate  
Materials  
and Types of  
Construction**

Any person desiring to use types of construction or materials not specifically mentioned in this Code shall file with the Building Inspector authentic proof in support of claims that may be made regarding the sufficiency of such types of construction and materials and request approval and permission for their use.

The Building Inspector may approve such alternate types of construction or materials and may recommend an amendment to this Code in order to make permissible the use of same. If the evidence and proof are not sufficient, in the opinion of the Building Inspector, to justify approval or recommendation for an amendment, the applicant may refer the entire matter to the Board of Examiners and Appeals as specified in Section 303.

**Sec. 303.** Any person whose application for a building permit for the use of a new material or method of construction has been refused by the Building Inspector or who may consider that the provisions of this Code do not cover the point raised or that any particular provision would cause a manifest injury to be done may appeal to the Board of Examiners and Appeals by serving written notice on the Building Inspector in which it shall be stated that the applicant desiring to use the alternate materials or types of construction shall guarantee payment of all expenses for necessary test made or ordered by the Board of Examiners and Appeals. Such notice

**Appeals**



shall be at once transmitted to the Board which Board shall arrange for a hearing on the particular point raised.

Such written notice shall be accompanied with the sum of ten dollars (\$10.00) payable to the ..... If the appeal be denied such fee shall be retained by the City of ....., otherwise the fee shall be returned to the appellant.

**Board of  
Examiners  
and Appeals**

**Sec. 304.** In order to determine the suitability of alternate materials and construction and to permit interpretations of the provisions of this Code, there shall be and is hereby created a Board of Examiners and Appeals, consisting of five (5) members, who are qualified by experience and training to pass on matters pertaining to building construction. One member shall be a practicing architect, one a competent builder, one a lawyer and two structural engineers, each of whom shall have had at least ten years' experience as an architect, builder, lawyer or structural engineer. The Building Inspector shall be an ex officio member and shall act as Secretary to the Board. The Board of Examiners and Appeals shall be appointed by ..... and shall hold office at ..... pleasure. The Board shall adopt reasonable rules and regulations for conducting its investigations and shall render all decisions and findings in writing to the Building Inspector with a duplicate copy to the appellant and may recommend to the City Council such new legislation as is consistent therewith.

The Board of Examiners and Appeals may interpret the provisions of the Code in a special case, if it appears that the provisions of the Code do not cover the point raised or that a manifest injustice might be done, provided that every such decision shall be by unanimous vote of the Board of Examiners and Appeals. Decisions as to the use of alternate materials and/or types of construction shall be by majority vote and if not covered by this Code shall become effective only when authorized by an amendment to this Code.

**Violations  
and  
Penalties**

**Sec. 305.** It shall be unlawful for any person to erect, construct, enlarge, alter, repair, move, remove, demolish, convert, equip, use or occupy or maintain any building and/or structure or any portion of any building and/or structure in the City of ....., contrary to or in violation of any provision of this Code or to cause, permit or suffer the same to be done.

Any person violating any of the provisions of this Code shall be deemed guilty of a misdemeanor and each such person shall be deemed guilty of a separate offense for each and every day or portion thereof during which any violation of any of the provisions of this Code is committed, continued or permitted, and upon the conviction of any such violation such person shall be punishable by a fine of not more than ..... or by imprisonment in the ..... jail for not more than ..... or by both such fine and imprisonment.

The issuance or granting of a permit or approval of plans and/or specifications shall not be deemed or construed to be a permit for, or an approval

of, any violation of any of the provisions of this Code. No permit presuming to give authority to violate or cancel the provisions of this code shall be valid, except insofar as the work or use which it authorizes is lawful.

The issuance of a permit upon plans and specifications shall not prevent the Building Inspector from thereafter requiring the correction of errors in said plans and specifications or from preventing building operations being carried on thereunder when in violation of this Code or of any other ordinances of the City of .....

Every permit issued by the Building Inspector under the provisions of this Code shall expire by limitation and become null and void, if the building or work authorized by such permit is not commenced within sixty days from the date of such permit is suspended or abandoned at any time after the work is commenced for a period of sixty days. Before such work can be recommenced a new permit shall be first obtained so to do, and the fee therefor shall be one-half the amount required for a new permit.

**PART II**  
**DEFINITIONS**  
**CHAPTER 4**

**Definitions**

**Sec. 401.** For the purpose of this Code, certain terms, phrases and words and their derivatives shall be construed as set out in this section. Words used in the singular include the plural and the plural the singular. Words used in the masculine gender include the feminine, and the feminine the masculine. Wherever a section, chapter or part is referred to in this Code by number it shall be understood to refer to a section, chapter or part of this Code.

“ALLEY” Any public space, public park or thoroughfare less than sixteen (16) feet but not less than ten (10) feet in width which has been deeded to the public for public use.

“ALTERATION” Alter or alteration means any change, addition or modification in construction or occupancy.

“APARTMENT HOUSE” is any building, or portion thereof, which is designed, built, rented, leased, let or hired out to be occupied, or which is occupied as the home or residence of three or more families living independently of each other and doing their own cooking in the said building, and shall include flats and apartments.

“APARTMENT” is a room or suite of rooms in an apartment house, which is occupied or which is intended or designed to be occupied by one family for living and sleeping purposes.

“APPROVED” as to materials and types of construction, refers to approval by the Building Inspector as the result of investigation and tests conducted by him, or by reason of accepted principles or tests by national authorities, technical or scientific organizations.

“AREA” or “FIRE AREA” (See “Floor Area”).

“ATTIC” or “ATTIC STORY” is any story situated wholly or partly in the roof, so designated, arranged or built as to be used for business, storage or habitation.

“BASEMENT” is that portion of a building between floor and ceiling, which is partly below and partly above grade (as defined in this section), but so located that the vertical distance from grade to the floor below is less than the vertical distance from grade to ceiling. (See “Story”).

“BAY WINDOW” is a rectangular, curved or polygonal window, supported on a foundation extending beyond the main wall of the building.

“BUILDING” is any structure built for the support, shelter and enclosure of persons, animals, chattels or movable property of any kind; and when separated by an “Absolute Fire Separation” each portion of such building so separated shall be deemed a separate building.

“BUILDING INSPECTOR” - the Chief Building Inspector or any regularly authorized deputy.

"CELLAR" is that portion of a building between floor and ceiling which is wholly or partly below grade (as defined in this section) and so located that the vertical distance from grade to the floor below is equal to or greater than the vertical distance from grade to ceiling. (See "Story").

"COURT" is an open, unoccupied space, bounded on two or more sides by the walls of the building. An inner court is a court entirely within the exterior walls of a building. All other courts are outer courts. (See Appendix).

"DEAD LOAD" in a building includes the weight of the walls, permanent partitions, framing, floors, roofs and all other permanent, stationary construction forming a part of the building.

"DWELLING" is any building or any portion thereof, which is not an "Apartment House" or a "Hotel" as defined in this Code, which contains one or more "Apartments" or "Guest Rooms", used, intended or designed to be used, built, rented, leased, let or hired out to be occupied, or which are occupied for living purposes.

"EXISTING BUILDING" is a building, already erected or one for which a legal permit has been issued prior to the adoption of this Code.

"FAMILY" is one person living alone or a group of two or more persons living together in an apartment, whether related to each other by birth or not.

"FLOOR AREA" is the area inside the exterior or fire walls of a building exclusive of vent shafts and courts.

"FRONT OF LOT" means the front boundary line of lot bordering on the street, and in the case of a corner lot may be either frontage.

"FOOTING" or "FOUNDATION" is the spreading course at the base or bottom of a foundation wall, column or pier.

"GARAGE" is a building or portion thereof in which a motor vehicle containing gasoline, distillate or other volatile, inflammable liquid in its tank, is stored, repaired, used or kept.

"PRIVATE GARAGE" is a building, or a portion of a building, in which motor vehicles used by the tenants of the building or buildings on the premises are stored or kept. (See Section 1509.)

"GRADE" (1) For buildings adjoining one street only, the elevation of the sidewalk at the center of that wall adjoining the street.

(2) For buildings adjoining more than one street, the average of the elevations of the sidewalk at centers of all walls adjoining streets.

(3) For buildings having no wall adjoining the street, the average level of the ground (finished surface) adjacent to the exterior walls of the building. All walls approximately parallel to and not more than five (5) feet from a street line are to be considered as adjoining a street.

"GUEST" means any person hiring and occupying a room for living and sleeping purposes.

"GUEST ROOM" means a room in a building occupied, or intended

and designed to be occupied, let or hired out to "Guests".

"HEIGHT OF BUILDING" is the vertical distance from the "Grade" to the highest point of the coping of a flat roof or to the deck line of a mansard roof or to the average height of the highest gable of a pitch or hip roof.

"HOTEL" is any building containing six or more rooms intended or designed to be used, or which are used, rented or hired out to be occupied, or which are occupied for sleeping purposes by guests.

"LINTEL" is the beam or girder placed over an opening in a wall, and which supports the wall construction above.

"LIVE LOADS" are all imposed, fixed or transient loads other than "Dead Loads."

"MASONRY" is that form of construction composed of stone, brick, concrete, gypsum, hollow clay tile, concrete blocks or tile, or other similar building units or materials or a combination of these materials laid up unit by unit and set in mortar. For the purpose of this Code plain monolithic concrete shall be considered as Masonry. (See Section 2404).

"SOLID MASONRY" means masonry built without hollow spaces.

"MEZZANINE" or "MEZZANINE FLOOR" is an intermediate floor placed in any story or room. When the total area of any such "Mezzanine Floor" exceeds thirty-three and one-third ( $33\frac{1}{3}$ ) per cent of the total floor area in that room or story in which said "Mezzanine Floor" occurs, it shall be considered as constituting an additional "Story". The clear height above or below a "Mezzanine Floor" construction shall be not less than seven (7) feet.

"OCCUPANCY" as used in this Code pertains to and is the purpose for which a building is used or intended to be used. Change of occupancy is not intended to include change of tenants or proprietors.

"ORIEL WINDOW" is a window that projects from the main line of an enclosing wall of a building and is carried on brackets or corbels.

"PERSON" means a natural person, his heirs, executors, administrators or assigns, and also includes a firm, partnership or corporation, its or their successors or assigns, or the agent of any of the aforesaid.

"REPAIR" means the reconstruction or renewal of any part of an existing building for the purpose of its maintenance. The word "Repair" or "Repairs" shall not apply to any change of construction.

"SEATING CAPACITY" - The seating capacity of a theatre, auditorium, or any room or place of public assemblage in which seats are not fixed shall be determined on the basis of seven (7) square feet of floor, balcony and/or gallery area per person.

"SHAFT" means a vertical opening through a building for elevators, dumbwaiter, light, ventilation or similar purposes.

"SHALL" as used in this Code, is mandatory.

"STORY" means that portion of a building included between the upper surface of any floor and the upper surface of the floor next above, except

that the topmost story shall be that portion of a building included between the upper surface of the topmost floor and the ceiling or roof above. A basement or cellar shall not be considered a story unless the ceiling thereof is more than five (5) feet above grade.

“STREET” is any thoroughfare or public park not less than sixteen (16) feet in width which has been dedicated or deeded to the public for public use.

“STRUCTURE” is that which is built or constructed, an edifice or building of any kind, or any piece of work artificially built up or composed of parts joined together in some definite manner.

“VALUE” of a building shall be the estimated cost to replace the building in kind.

“VENEER” is the outer facing of brick, stone, concrete or tile attached to an enclosing wall for the purpose of providing ornamentation, protection or insulation but not counted as adding strength to the wall.

“WALLS”.

“BEARING WALL” is a wall which supports any load other than its own weight.

“CURTAIN WALL” is a non-bearing wall between columns or piers which is not supported by girders or beams.

“ENCLOSURE WALL” is an exterior, non-bearing wall in skeleton construction, anchored to columns, piers or floors, but not necessarily built between columns or piers.

“FIRE DIVISION WALL” is a wall of masonry or reinforced concrete which subdivides a building to restrict the spread of fire, but is not necessarily continuous through all stories nor extended through the roof.

“FIRE WALL” is a wall of masonry or reinforced concrete which subdivides a building to prevent the spread of fire by starting at the foundation and extending continuously through all stories to and above the roof.

“INTERIOR WALL” is a wall entirely surrounded by the exterior walls of the building.

“NON-BEARING WALL” is a wall which supports no load other than its own weight.

“PANEL WALL” is a non-bearing wall in skeleton construction built between columns or piers and wholly supported at each story.

“PARAPET WALL” is that part of any wall entirely above the roof line.

“PARTY WALL” is a wall used or adapted for joint service between two buildings.

“RETAINING WALL” is any wall used to resist the lateral displacement of any material.

“YARD” is an open, unoccupied space, other than a court, unobstructed from the ground to the sky, except where specifically provided by this Code, and on the lot on which a building is situated.

**PART III**

**REQUIREMENTS BASED ON OCCUPANCY  
CHAPTER 5 — CLASSIFICATION OF ALL BUILDINGS  
BY USE OR OCCUPANCY AND GENERAL  
REQUIREMENTS FOR ALL OCCUPANCIES**

**Occupancy  
Classified**

**Sec. 501.** Every building, whether existing or hereafter erected, shall for the purpose of this Code be classified by the Building Inspector according to its use or the character of its occupancy, as a building of Group A, B, C, D, E, F, G, H, I or J, as defined in Chapters 6, 7, 8, 9 10, 11, 12, 13, 14 and 15 respectively. (See Chart in Section 503.)

Any occupancy not mentioned specifically or about which there is any question shall be classified by the Building Inspector and included in the Group which its use most nearly resembles based on the existing or proposed life and fire hazard.

The Types of Construction referred to in Chapters 6 to 15 inclusive, are:

Type I—Fire-Resistive Construction,

Type II—Heavy Timber Construction,

Type III—Ordinary Masonry Construction,

Type IV—Metal Frame Construction,

Type V—Wood Frame Construction,

and are defined in Chapters 18, 19, 20, 21 and 22 respectively.

**Change in  
Use**

**Sec. 502.** When the use or the character of the occupancy of any building is changed from one Group to another Group such building if not conforming to the requirements for the proposed use or occupancy, shall be remodeled to comply with the requirements of this Code for the proposed use or occupancy.

No such change in use or occupancy shall be made until a Certificate of Occupancy is issued by the Building Inspector as specified in Section 207 of this Code.

Buildings in existence at the time of the passage of this Code may have their existing use or occupancy continued if such use or occupancy was legal at the time of the passage of this Code.

**Mixed  
Occupancy**

**Sec. 503.** (a) When the occupancy of a building is such that different portions of the building are placed in different occupancy Groups, the whole building shall comply with the most restrictive requirements of all such Groups unless a "Fire Separation" as specified in this Section is provided so that each Group is entirely segregated. Such "Fire Separation" shall provide either a complete vertical or horizontal separation, or a combination of both. Each portion of a building so segregated shall be considered, for the purpose of this Code, to be a separate building and as such shall conform to the specific requirements applying to that use or occupancy; provided, however, that "Fire Separations" shall not affect or alter the requirements for fire walls when and where required because of area as specified in Part III, except when such "Fire Separation" provides

the necessary complete vertical separation as specified in Section 2932.

(b) "Fire Separations" may be vertical and/or horizontal, depending upon the locations of the portions of the building to be segregated and shall consist of a system of walls, partitions and/or floors of materials and construction so arranged as to provide, during the period specified, a complete, secure and continuous fire-break between the buildings or portions thereof as required. "Fire Separations" are, for the purpose of this Code, classified as "Absolute", "Special" and "Ordinary" and shall be not less than as specified in the following paragraphs.

(1) An "Absolute Fire Separation" shall provide an effective resistance to the passage of fire for not less than four hours as specified in Chapters 42 and 43. No openings shall be allowed through an "Absolute Fire Separation."

(2) A "Special Fire Separation" shall provide an effective resistance to the passage of fire for not less than three hours as specified in Chapters 42 and 43, except that all openings in walls forming such separation shall be protected on each side thereof by self-closing one hour fire-resistive doors as specified in Section 4304 (a). Such doors shall be kept normally closed. The total width of all openings in any vertical "Special Fire Separation" shall not exceed in any one story twenty-five (25) per cent of the length of the wall in that story and no single opening shall have an area greater than one hundred twenty (120) square feet.

Enclosure walls of vertical or horizontal enclosures passing through a "Special Fire Separation" shall be of not less than two hour fire-resistive construction as specified in Section 4304.

(3) An "Ordinary Fire Separation" shall provide an effective resistance to the passage of fire for not less than one hour as specified in Chapters 42 and 43. Openings in "Ordinary Fire Separations" shall be protected by self-closing metal clad doors, as provided in Section 4304 and such doors shall be kept normally closed.

(c) "Fire Separations" shall be provided between the various Groups and Divisions of occupancies as specified in the tabulation which follows Section 504.

**Sec. 504.** The location of all buildings and the protection of certain openings shall conform to the requirements of the Occupancy Group in which such building is classified in this Code according to the use or character of the occupancy; provided, that exterior walls which form a right angle of seventy-five (75) degrees or more with the adjacent property line may have openings therein which are protected by not less than one-hour fire-resistive construction as specified in Section 4304.

The specific requirements given in Sections 603, 703, 803, 903, 1003, 1103, 1203, 1303, 1403, and 1503, regulating the construction of exterior walls and the protection of openings therein with respect to adjacent property lines, shall apply to buildings erected on the same property, but with reference to an imaginary property line located between such buildings and parallel to the face of either building.

**Location on  
Property**



**"FIRE SEPARATIONS" REQUIRED FOR MIXED OCCUPANCY**

OCCUPANCY			GROUPS AND DIVISIONS OF OCCUPANCY																							
Chapter Reference	Group	Division #	A			B		C	D		E			F			G			H	I	J†				
			1	2	3	1	2	1	1	2	1	2	3	1	2	3	1	2	3	1	2	1	1	2	3	
6	A	1—Major theatres (stage depth back of proscenium wall more than 5 feet) .....	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	S	A	A	A		
		2—Moving Pictures theatres (seating 1000 or more) .....	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	S	S	S	A	A	A	
		3—Places of public assemblage (other than theatres or moving picture theatres) having a seating capacity of 3500 or more in any one room .....				A	A	A	A	A	A	A	A	A	A	A	A	A	A	S	S	S	A	A	A	
		Except: Lodges not used for public gatherings.																								
7	B	1—Theatres and moving picture theatres (stage depth back of proscenium wall 5 feet or less) .....				A	A	S	A	A	A	A	A	S	S	A	A	A	S	S	S	A	A	A		
		2—Same as Group A, Division 3, but having a seating capacity of 500 to 3500 in any one room .....				S	S	A	S	S	A	A	S	A	A	S	S	S	S	S	S	A	S	S		
8	C	1—Same as Group A, Division 3, but having a seating capacity in any one room of less than 500 .....						S	S	S	A	A	A	O	S	A	O	O	O	O	O	O	O	O		
9	D	1—Jails, prisons, reformatories, asylums, similar buildings .....						S	S	A	A	A	A	A	A	A	O	O	A	A	O	A	A	A		
		2—Hospitals, sanitariums, orphanages, nurseries and similar buildings (accommodating more than 6 patients) .....						S	A	A	A	A	A	A	A	O	O	S	S	O	S	S	S			
10	E	1—Public garages, paint or petroleum products storage, dry cleaning .....								S	A	A	A	A	A	A	O	O	A	A	O	N*	A	S		
		2—Planing mills, box factories, woodworking and mattress factories .....								S	A	A	A	A	S	O	O	A	A	O	O	N	A			
		3—Storage of hay and highly inflammable or explosive materials .....									A	A	A	A	A	A	A	A	A	A	A	A	A			
11	F	1—Wholesale and retail stores, office buildings, restaurants, undertaking parlors, printing plants, municipal police and fire stations .....												O	S	A	S	O	O	S	S	N	O	N	O	
		2—Factories and workshops using materials not highly inflammable or explosive .....												S	S	S	O	O	A	A	O	O	N	S		
		3—Storage and sales rooms for combustible goods .....												S	S	S	S	S	A	A	A	A	A	A		
12	G	1—Ice plants, power plants, pumping plants, cold storage, creameries .....															O	N	N	A	A	O	O	N	N	
		2—Factories and workshops using incombustible or non-explosive materials .....															N	N	O	O	O	N	N	N		
		3—Storage and sales rooms of incombustible or non-explosive goods .....															N	O	O	O	N	N	N			
13	H	1—Hotels, apartment houses, dormitories, lodging houses .....																	O	O	N	O	O	S		
		2—Convents, monasteries, old peoples' homes (accommodating 10 or more) .....																	O	N	O	O	S			
14	I	1—Dwellings .....																			O	O	N	O		
15	J	1—Private garages .....																				O	N	O		
		2—Accessory buildings and structures such as tents, sheds, fences over 6 feet high, water tanks, towers .....																					N	N		
		3—Stadiums, reviewing stands, amusement park structures .....																						O		

Legend: A—Absolute Separation. S—Special Separation. O—Ordinary Separation. N—No separation required.

Note: #Refer to Chapters 6 to 15 inclusive for more complete listing of occupancies and definitions.

†Separations noted apply to sheds and similar buildings only which may be used for storage.

\*Jails and municipal police stations may be separated by S.

‡Garages that are completely sprinkled as required in Chapter 38 may be separated by S from hotels, apartment houses and buildings in Division 1 of Group F.

§Restaurants in buildings of Division 1 in Group H may have separation omitted when operated in conjunction by same proprietor.

\*\*"Special Fire Separation" shall be provided between Group J-1 occupancies and dry-cleaning establishments and paint and petroleum products storage of Group E-1.

## CHAPTER 6 — REQUIREMENTS FOR GROUP A BUILDINGS

**Sec. 601.** Each Group A occupancy shall be considered as a separate building and the Group shall include:

Division 1: All major theatres having a permanent stage, with a depth of more than five (5) feet between the proscenium wall and the rear wall, upon which permanent and/or transient stage scenery and theatrical apparatus is or may be installed.

Division 2: All motion picture theatres having a stage as noted above and/or having a seating capacity of one thousand (1000) or more.

Division 3: All auditoriums, schools, churches, lodges, clubs, museums, dance halls, armories, libraries, passenger stations, administration buildings of the city, county or state and similar buildings having a total seating capacity of more than thirty-five hundred (3500) in any one room.

**Sec. 602.** (a) General. Buildings or parts of buildings classed in Group A because of use or occupancy shall be of Type I Construction and shall not be limited as to location in fire zone, seating capacity, height or floor area.

(b) Special Construction. The stage portion of the building shall be of Type I Construction except as specified in Section 608.

The stage shall be completely separated from the auditorium by a wall extending not less than four (4) feet above the roof over the stage and designated a proscenium wall, of four-hour fire-resistive construction as specified in Section 4302. Such wall may have in addition to the main proscenium opening one opening at the orchestra pit level and not more than two openings at the stage floor level, each of which shall be not more than twenty-five (25) square feet in area and shall be protected on each side thereof by a one-hour fire-resistive door as specified in Section 4304. The proscenium opening, which shall be the main opening for viewing performances, shall be provided with a self-closing curtain as specified in Chapter 41.

The dressing room section, workshops and storerooms shall not be located under or on the stage nor in the auditorium but shall be separated from each other and from the stage by a "Special Fire Separation" as specified in Section 503.

The slope of the main floor of the auditorium shall not exceed one (1) in eight (8).

**Sec. 603.** All Group A buildings shall front directly upon at least one public street not less than twenty (20) feet in width in which front shall be located the main entrance and exit of such building. The main floor of every Group A occupancy shall be located at or near the ground floor level.

All exterior walls or parts of walls, except on street fronts, of Group A buildings which are less than five (5) feet from adjacent property lines shall have no openings therein. All openings in exterior walls, except on street fronts, which are less than ten (10) feet from adjacent property lines shall

**Group A  
Occupancies  
Defined**

**Construction,  
Height and  
Area  
Allowable**

**Location on  
Property**

be protected by doors or windows of one-hour fire-resistive construction as specified in Section 4304. See Section 504 for regulating adjacent buildings on the same property.

**Stairs and Exits**

**Sec. 604.** (a) Main Entrance and Exits. In every Group A building there shall be not less than one (1) exit on each of three sides of the auditorium and one from each side of every balcony or gallery. Each of these exits shall be not less than four (4) feet in width and shall open directly upon a street or into an open court or space not less than ten (10) feet in width which shall be directly connected to a street.

One such exit on a street front which shall serve as the main entrance shall be proportioned on the basis of two (2) feet of width for each one hundred (100) persons or major fraction thereof to and including one thousand (1000) persons, with an additional one (1) foot per hundred persons for each additional one hundred (100) persons or major fraction thereof to and including two thousand (2000) persons and an additional six (6) inches for each additional one hundred (100) persons, all based upon the total seating capacity of the building served by such entrance and/or exit, plus the number of persons allowed in the foyer and lounging rooms as provided in part (1) of this Section.

At the main entrance of each Group A building there shall be a foyer having an area of one (1) square foot to each seat in such building having access to such foyer. The foyer shall be at the same level as the back of the auditorium and all changes in elevation between foyer and the public street adjacent thereto shall be by ramps with a slope of not more than one (1) in ten (10).

The foyer if not abutting directly upon a public street shall communicate thereto by a straight and unobstructed corridor or passageway equal in width to that required for the main entrance which shall be used only as an exit or entrance; provided, however, that not to exceed ten (10) per cent of such required width may be used for the placing of a ticket booth.

(b) Exit Courts. Along each side and the full length of the side of the auditorium not fronting directly upon a street (not including that side bounded by the stage) shall be an open court or space not less than ten (10) feet in width when the total seating capacity is one thousand (1000) or less, and such width shall be increased by one (1) foot for each additional five hundred (500) persons or major fraction thereof. These required widths may be reduced by fifty (50) per cent if there are no balconies or galleries or if all balcony and/or gallery exits lead directly to a street and are not connected with such exit court in any manner.

The courts shall extend full width to a street or shall be connected to the street by a passageway of the same required width, with a height of not less than seven (7) feet and shall not exceed a length of fifty (50) feet. The court or passageway shall meet the street level and all changes in elevation shall be by ramps with a slope of not more than one (1) in eight (8).

All doors opening into such courts or open spaces shall be arranged so as not to decrease the clear width of the court when open.

(c) **Main Floor Auditorium Exits.** Exits, located on each side of and not less than one-half the length of the auditorium from the foyer, shall be provided on the main floor of each Group A building. These exits shall be proportioned on the basis of not less than twenty-two (22) inches of combined width to each one hundred fifty (150) seats or major fraction thereof on the main floor of the auditorium, and this exit width shall be equally divided to each side of the auditorium. All such exits shall open directly upon a street or exit court or may be connected thereto by corridors having a width not less than the exit opening into same. There shall be no openings in such corridors other than the exit openings, and the exit doors shall be hung so as not to decrease the required width. Egress from the main floor of the auditorium to the street shall be by means of ramps having a slope of not more than one (1) in eight (8), except as specified in part (a) of this Section.

Where fixed seats are not provided the exits shall be proportioned on the seating capacity as defined in Section 401.

(d) **Balcony and Gallery Exits.** Exits shall be provided from each side of each balcony or gallery, leading to a street or exit court. These exits shall have a combined width of not less than twenty-two (22) inches for every seventy-five (75) seats or major fraction thereof in such balcony or gallery and such exits shall be equally divided to each side. No exit shall be less than three feet and six inches (3 ft.-6 inches) in width and shall be served by stairs or ramps completely enclosed and constructed as specified in Chapter 33. All such exits shall be located as far apart as is practicable and all combined exits shall continue the full combined width to the street. No stair exit shall be continued to or communicate with a basement.

Where fixed seats are not provided the exits shall be proportioned on the seating capacity as defined in Section 401.

A handrail shall be provided on each side of every stair four (4) feet or more in width, and on one side of each stairway three feet six inches (3' 6") or less in width.

Stairs emptying into exit courts shall meet the court floor at not less than the stair width from the near side of any main floor exit opening into such exit court.

(e) **Stage Exits.** Not less than one exit two feet and six inches (2 ft. 6 inches) wide shall be provided from each side of the stage opening directly or by means of a passageway not less than three (3) feet in width to a street or exit court. An exit stair not less than two feet and six inches (2 ft. 6 inches) wide shall be provided for egress from each fly gallery. Each tier of dressing rooms shall be provided with at least two means of egress not less than two feet and six inches (2 ft. 6 inches) wide and all such stairs shall be constructed as specified in Chapter 33. The stairs required in this subsection need not be enclosed.

(f) **Aisles.** Aisles on the main floor shall be located so that there are not more than six (6) seats between any seat and an aisle. Every aisle shall be

not less than two feet and six inches (2 ft. 6 inches) wide if having seats on only one side and not less than three (3) feet wide if having seats on both sides. Such minimum width shall be measured at the end farthest from the foyer and shall be increased by two (2) inches for each ten (10) feet in length toward the foyer for aisles having seats on one side only, and three (3) inches for each ten (10) feet in length toward the foyer for aisles having seats on both sides. There shall be no steps or obstructions of any kind in any aisles, and aisles may have a slope of not more than one (1) in eight (8).

Aisles in balconies or galleries shall be located so that there are not more than five (5) seats between any seat and an aisle. Aisles shall be not less than three feet and six inches (3 ft. 6 inch.) in width. There shall be provided in all balconies or galleries having more than twenty (20) rows of seats a cross aisle not less than three (3) feet wide from the back of one chair to the edge of the seat when down in the next row. Such cross aisle shall lead directly to an entrance or to an emergency exit.

Risers shall be not more than seven and one-half (7<sup>1/2</sup>) inches and shall be the full width of the aisle and no tread shall be less than ten (10) inches. When the slope of the aisle is not more than one (1) in eight (8) it shall be ramped. All aisles shall be not less than three feet and six inches (3 ft. 6 inches) in clear width and shall lead directly to exits.

(g) Seats. Seats on the main floor shall be spaced not less than thirty-three (33) inches back to back and there shall be not more than six (6) seats between any seat and an aisle.

Seats in balconies or galleries shall be spaced not less than thirty (30) inches back to back and there shall be not more than five (5) seats between any seat and an aisle.

All seats in buildings of Divisions 1 and 2 of Group A and in buildings of Division 3 when used for assembly purposes on the main floor and in balconies and galleries shall be fastened securely to the floor and shall be not less than eighteen (18) inches in minimum width.

(h) Boxes. Boxes may be served by stairs not less than three (3) feet in width with a rise and tread as required for main stair exits. Boxes accommodating more than twenty-five (25) persons shall be considered as balconies. Seats in boxes need not be fastened to the floor.

(i) Doors and Gates. All exit and entrance doors or gates shall swing in the direction of exit travel and if provided with latches such latches shall be of self-releasing type, such as panic bolts or similar devices, which will permit the door to open when pressed against. All doors shall be installed so as not to decrease the required width of any opening, passageway or corridor in any manner whatsoever. No single door shall be more than three feet and six inches (3 ft. 6 inches) in width and every exit door on the exterior of such building shall be of not less than one-hour fire-resistance as specified in Section 4304 except at the main entrance and exit. Doors opening from within the building into a stair or ramp enclosure may be metal-clad doors as specified in Section 4304.

(j) Exit Lights. All exits shall be marked with illuminated signs bearing the word "EXIT" in letters at least six (6) inches high. Each sign shall be provided with two (2) separate electric light globes each on separate circuits, one circuit being separate from any other circuit in the building. All exit signs shall be illuminated during any time the building is occupied.

(k) **Smokeproof Tower.** Where there is more than one balcony or gallery all balconies or galleries above the first shall be served by not less than one smokeproof tower located on each side of such balcony or galley and constructed as specified in Chapter 33.

(l) **General.** Any exits which are combined shall be continued the full combined width to the street.

No persons or obstructions of any kind, either permanent or movable shall be placed in any aisle, exit passageway or corridor and all dimensions given shall refer to the clear width. This shall be construed as prohibiting radiators, chairs, stools, stands, slot machines, easels and similar objects from being placed in any exit, aisle, passageway or corridor.

The number of persons allowed in the foyer and lounging rooms during a performance shall not exceed that number determined on the basis of one (1) person to each twelve and one-half (12½) square feet of floor area in such foyer and lounging rooms exclusive of the passageways from the aisles, ramps and/or stairs to the exits. Seating accommodations may be provided for such number of persons providing the seats or chairs are not placed in any required exit, aisle, passageway or corridor space.

No bars shall be placed upon any window or any other opening in any Group A building.

All doors shall have a clear height of not less than six feet and eight inches (6 ft. 8 inches).

**Sec. 605.** All portions of Group A buildings customarily used by human beings and all dressing rooms shall be provided with light and ventilation by means of windows and/or skylights with an area not less than one-eighth (1/8) of the total floor area, or shall be provided with artificial light and a mechanically operated ventilating system. The mechanically driven ventilating system shall supply at least thirty (30) cubic feet of pure air per minute for each occupant thereof in all portions of the building and such system shall be kept continuously in operation during such time as the building is occupied. If the velocity of the air at the register exceeds ten (10) feet per second the register must be placed more than eight (8) feet above the floor directly beneath.

Lights in all parts of the building customarily used by human beings shall be on a separate circuit from that of the stage and shall be controlled from the box office. Lights in corridors, exit courts and exit passageways shall be protected by a wire cage.

All registers or vents supplying air back stage shall be equipped with automatic closing devices with fusible links.

**Sec. 606.** Main stair or ramp exits from the first or lower balcony or gallery need not be enclosed but all other stair exits shall be enclosed as specified in Chapter 30. There shall be no openings into stair or ramp enclosures except necessary entrance and exit doors. All emergency stair or ramp enclosures shall lead directly to a public street or alley or exit court.

All elevator shafts, vent shafts and other vertical openings shall be enclosed as specified under Types of Construction.

## **Light and Ventilation**

## **Enclosure of Vertical Openings**

Openings through stage floors shall be equipped with tight fitting trap doors of wood not less than two (2) inches thick.

**Fire  
Extinguishing  
Apparatus**

**Sec. 607.** Stages, basements, property rooms, dressing rooms and all portions of the stage and rooms under the stage and back of the proscenium wall shall be equipped with automatic sprinklers as specified in Chapter 38.

A two (2) inch wet standpipe shall be provided on each side of the stage and on each side of the rear of the auditorium extending to and having connections at the balcony level. A four (4) inch dry standpipe shall be located at or near a stage exit door and in each smokeproof tower, each equipped with a Siamese inlet located on the main street front of the building. Such standpipes shall be constructed and equipped as specified in Chapter 38.

In the roof of every stage there shall be an automatic ventilator having a free ventilating area of not less than one-tenth ( $\frac{1}{10}$ ) the area of the stage, constructed as specified in Section 3901.

**Special  
Hazards**

**Sec. 608.** Where any of the special hazards mentioned below are present the detailed regulations applying to such hazards as specified in the chapters indicated shall be complied with:

Moving picture booths, Chapter 40.

Chimney and heating apparatus, Chapter 37.

No inflammable liquids shall be placed, stored or used in a Group A building; except, that in paint-shops and work-shops inflammable liquids of Class III, as defined in Section 1008, may be used and stored in quantities of not to exceed a total of one hundred (100) gallons, and that liquids of Class I and II may be used and stored in quantities not to exceed a total of one (1) gallon provided that all such liquids not in actual use shall be kept in tight or sealed containers.

Any gas service to the stage portion of the building shall be separate from any other service to the building and shall be provided with a shut-off valve outside the stage entrance and adequately marked.

Every boiler room or room containing a heating plant shall be separated from the rest of the building with an "Absolute Fire Separation" as specified in Section 503.

**Exceptions  
and  
Deviations**

**Sec. 609.** Gridirons, fly-galleries and pin-rails shall be constructed of incombustible materials and fireproofing of steel and iron may be omitted. Gridirons and fly-galleries shall be designed to support not less than seventy-five (75) pounds per square foot.

All parts of the stage which are not movable shall be of incombustible construction except that part of the stage extending back from and the full width of the proscenium opening which if not of fire-resistive construction shall be constructed of steel or heavy timbers covered with a wood floor not less than one and five-eighths ( $1\frac{5}{8}$ ) inches thick. No part of the combustible construction shall be carried through the proscenium wall. All parts of the

stage floor shall be designed to support not less than one hundred (100) pounds per square foot.

A protecting hood shall be provided over and the full length of the stage switchboard.

Gymnasiums and similar buildings may have running tracks constructed of wood or unprotected steel or iron.

Note: Existing buildings not complying with the requirements of this chapter may be classed as Group A buildings and so used if the requirements of Sections 602, 604, 607, 608 and 609 are fully complied with and not less than a "Special Fire Separation" as specified in Section 503 is provided as a separation between the Group A occupancy and all other adjacent occupancies.

**Sec. 610.** Separation of Group A occupancies from all other occupancies shall be provided as specified in Section 503.

**Mixed  
Occupancies**



## CHAPTER 7 — REQUIREMENTS FOR GROUP B BUILDINGS

### Group B Occupancies Defined

**Sec. 701.** Each Group B occupancy shall be considered as a separate building and the Group shall include:

Division 1: All theatres, motion picture theatres, auditoriums and places of public assembly, having no stage or having a permanent stage with a depth of five (5) feet or less between the proscenium wall and the rear wall upon which permanent and/or transient stage scenery and theatrical apparatus is or may be installed or used.

Division 2: Auditoriums, schools, churches, lodges, clubs, museums, dance halls, armories, gymnasiums, libraries, passenger stations, administration buildings of city, county or state, and similar buildings having a total seating capacity in any one room of five hundred (500) or more but less than thirty-five hundred (3500).

### Construction, Height and Area Allowable

**Sec. 702.** (a) General. Buildings or parts of buildings classed in Group B because of use or the character of the occupancy shall conform to the following specific requirements:

Type of Construction Permissible	Permitted in Fire Zone	Height Limit (Ft.)	Maximum Total Seating Capacity in Any One Room	Floor Area Permissible (Sq. Ft.)
Type I	1, 2 or 3	No Limit	3500	No Limit
Type II	1, 2 or 3	75	1500*	No Limit
Type III	2 or 3	55	1000*	15,000

\*Seating capacity may be increased, except for Division 1 Group B occupancies, not to exceed fifty (50) per cent when no balconies or galleries are constructed as a part of such building and when the auditorium floor is located at or near ground floor level, in which case all exits shall be at street level or shall meet street level by means of ramps.

(b) Special Construction. When a stage is provided for the use of permanent and/or transient stage scenery or theatrical apparatus it shall be completely separated from the auditorium by a wall designated the proscenium wall, of not less than one-hour fire-resistive construction as provided in Section 4302. All openings, except the proscenium opening, in such wall shall be not more than twenty-five (25) square feet in area and shall be protected by metal-clad doors constructed as specified in Section 4304. The proscenium opening, which shall be the main opening for viewing performances, shall be provided with a self-closing curtain installed and arranged to operate as specified in Chapter 41.

### Location on Property

**Sec. 703.** All Group B buildings shall front directly upon at least one public street not less than twenty (20) feet in width, in which front shall be located the main entrance and exit of such building, or such building may be connected to the street by an entrance passageway as specified in

**Section 704.** The main floor of each Group B occupancy shall be located at or near the ground floor level, provided that occupancies in Division 2 of Group B buildings having a total seating capacity of not more than fifteen hundred (1500) may be located above the ground floor or in the first basement, and stairs may be used as a means of ingress and egress.

All exterior walls or parts of walls, except on street fronts, of Group B buildings which are less than five (5) feet from adjacent property lines shall have no openings therein. All openings in exterior walls, except on street fronts, which are less than ten (10) feet from adjacent property lines shall be protected by doors or windows of one-hour fire-resistive construction as specified in Section 4304. See Section 504 for regulating adjacent buildings on the same property.

**Sec. 704. (a) Main Entrance and Exits.** In every Group B building there shall be not less than three exits each not less than four (4) feet in width leading directly to streets, to alleys or to courts or other open spaces on the same property which lead directly to streets or alleys, and two such exits shall be located at or near the end of the auditorium opposite from the main entrance. One such exit shall open directly upon or be connected by means of a straight passageway to a street not less than twenty (20) feet in width and such main entrance and passageway shall be proportioned on the basis of two (2) feet of width for each one hundred (100) persons or major fraction thereof to and including one thousand (1000) persons, with an additional one (1) foot for each additional one hundred (100) persons or major fraction thereof to and including two thousand (2000) persons and an additional six (6) inches for each additional one hundred (100) persons or major fraction thereof, all based upon the total seating capacity of the building served by such entrance and/or exit plus the number of persons allowed in the foyer and lounging rooms as provided in part (k) of this Section.

#### **Stairs and Exits**

Each balcony and gallery shall have not less than one exit not less than three feet and six inches (3 ft. 6 in.) wide on each side thereof.

All changes in elevation along any exits, aisles, or passageways of all Division 1 Group B buildings shall be by ramps with a slope of not more than one (1) in eight (8), except that the main entrance shall be sloped not more than one (1) in ten (10).

**(b) Main Floor Auditorium Exits.** Exits located at the end of the auditorium opposite from the main entrance shall be proportioned on the basis of twenty-two (22) inches of combined width to each one hundred fifty (150) seats or major fraction thereof on the main floor of the auditorium and this exit width shall be equally divided to each side of the auditorium. When more than two five (5) foot exits are required the remaining required exits shall be placed on the sides of the auditorium but not less than one-half ( $\frac{1}{2}$ ) the length of the auditorium from the main entrance.

When fixed seats are not provided the exits shall be proportioned on the seating capacity as defined in Section 401.

(c) **Balcony and Gallery Exits.** Exits shall be provided from each side of each balcony or gallery leading to a street or alley, or to a court or open space on the same property leading directly to a street or alley. These balcony exits shall have a combined width of not less than twenty-two (22) inches to every seventy-five (75) seats or major fraction thereof in such balcony or gallery and such exits shall be equally divided to each side.

All stairs serving as exits from Group B buildings shall be constructed as specified in Chapter 33, except as specified in part (k) of this Section.

(d) **Stage Exits.** Each stage shall have not less than one exit two feet and six inches (2 ft. 6 in.) wide opening directly or by means of a passageway not less than three (3) feet in width to a street or alley. Each dressing room shall be provided with at least two means of egress not less than two feet and six inches (2 ft. 6 in.) wide. Stairs required in this Sub-section (d) shall have a rise and tread as specified in Chapter 33 but such stairs need not be enclosed.

(e) **Aisles.** Aisles on the main floor shall be located so that there are not more than six (6) seats between any seat and an aisle. Every aisle shall be not less than two feet and six inches (2 ft. 6 in.) wide if having seats on only one side and not less than three (3) feet wide if having seats on both sides. Such minimum width shall be measured at the end farthest from the foyer and shall be increased by two (2) inches for each ten (10) feet in length toward the foyer for aisles having seats on one side only, and three (3) inches for each ten (10) feet in length toward the foyer for aisles having seats on both sides. There shall be no steps or obstructions of any kind in any aisles, and aisles may have a slope of not more than one (1) in eight (8).

Aisles in balconies or galleries shall be located so that there are not more than five (5) seats between any seat and an aisle. Aisles shall be not less than three feet and six inches (3 ft. 6 in.) in width. There shall be provided in all balconies or galleries having more than twenty (20) rows of seats a cross aisle not less than three (3) feet wide from the back of one chair to the edge of the seat when down in the next row. Such cross aisle shall lead directly to an entrance or to an emergency exit.

Risers shall be not more than seven and one-half (7 1/2) inches and shall be the full width of the aisle and no tread shall be less than ten (10) inches. When the slope of the aisle is not more than one (1) in eight (8) it shall be ramped. All aisles shall be not less than three feet and six inches (3 ft. 6 in.) in clear width and shall lead directly to exits.

(f) **Seats.** Seats on the main floor shall be spaced not less than thirty-three (33) inches back to back and there shall be not more than six (6) seats between any seat and an aisle.

Seats in balconies or galleries shall be spaced not less than thirty (30) inches back to back and there shall be not more than five (5) seats between any seat and an aisle.

In all buildings of Division 1 of Group B and in buildings of Division 2 used for public assemblage all seats on the main floor and in balconies and

galleries shall be fastened securely to the floor and shall be not less than eighteen (18) inches in minimum width.

(g) **Boxes.** Boxes may be served by stairs not less than three (3) feet in width with a rise and tread as required for main stair exits. Boxes accommodating more than twenty-five (25) persons shall be considered as balconies. Seats in boxes need not be fastened to the floor.

(h) **Doors and Gates.** All exit and entrance doors or gates shall swing in the direction of exit travel and if provided with latches such latches shall be of a self-releasing type, such as panic bolts or similar devices, which will permit the door to open when pressed against. All doors shall be installed so as not to decrease the required width of any opening, passageway or corridor in any manner whatsoever. No single door shall be more than three feet and six inches (3'-6") in width and every exit door on the exterior of such building shall be of not less than one-hour fire resistance as specified in Section 4304, except at the main entrance and exit. Doors opening from within the building into a stair or ramp enclosure shall be constructed as specified in Section 4304.

(i) **Exit Lights.** All exits shall be marked with illuminated signs bearing the word "EXIT" in letters at least six (6) inches high. Each sign shall be provided with two (2) separate electric light globes each on separate circuits, one circuit being separate from any other circuit in the building. All exit signs shall be illuminated during any time that the building is occupied.

(j) **Smokeproof Tower.** Where there is more than one balcony or gallery all balconies or galleries above the first shall be served by not less than one (1) smokeproof tower located on each side of such balcony or gallery and constructed as specified in Chapter 33. Not less than one smokeproof tower constructed as specified in Chapter 33 shall be installed to serve each Group B occupancy placed above the third floor of any building, and one additional such exit shall be installed for each additional twenty thousand (20,000) square feet or major fraction thereof in excess of fifteen thousand (15,000) square feet. Such exits shall be placed as far apart as possible.

(k) **General.** Any exits which are combined shall be continued the full combined width to the street or alley.

No persons or obstructions of any kind, either permanent or movable, shall be placed in any aisle, exit, passageway or corridor and all dimensions given shall refer to the clear width. This shall be construed as prohibiting radiators, chairs, stools, stands, slot machines, easels and similar objects from being placed in any exit, aisle, passageway or corridor.

The number of persons allowed in the foyer and lounging rooms during a performance shall not exceed that number determined on the basis of one (1) person to each twelve and one-half (12½) square feet of floor area in such foyer and lounging rooms exclusive of the passageways from the aisles, ramps and/or stairs to the exits. Seating accommodations may be provided for such number of persons providing the seats or chairs are not

placed in any required exit, aisle, passageway or corridor space.

No bars shall be placed upon any window or any other opening in any Group B building.

All stairs and ramps serving as entrances or exits for any Group B occupancy shall be designed and constructed as specified in Chapter 33; provided, that when such Group B occupancy is located on the second floor of a two-story building or when leading to and serving such occupancy only, such stairs or ramps need not be enclosed when stairs lead directly to the outer air or are connected thereto by direct passages with unpierced walls and ceilings. All emergency stair or ramp enclosures shall lead directly to a public street or alley or to a court or space not less than five (5) feet in clear width connected directly to a street or alley.

**Light and Ventilation**

**Sec. 705.** All portions of Group B buildings customarily used by human beings and all dressing rooms shall be provided with light and ventilation, either natural or artificial, as specified in Section 605.

**Enclosure of Vertical Openings**

**Sec. 706.** All vertical openings such as elevator shafts, stairs, ramps and vent shafts shall be enclosed as specified in Chapter 30, provided, however, that stair or ramp exits serving only a Group B occupancy on the second floor of a building need not be enclosed. There shall be no openings into stair or ramp enclosures except necessary entrance and exit doors.

**Fire Extinguishing Apparatus**

**Sec. 707.** Automatic sprinklers, standpipes and basement pipe inlets shall be installed as and when specified in Chapter 38.

**Special Hazards**

**Sec. 708.** Chimneys and heating apparatus shall conform to the requirements of Chapter 37.

Motion picture machine booths shall conform to the requirements of Chapter 40.

No inflammable liquids shall be placed, stored or used in a Group B building.

Any gas service to a Group B building shall be provided with an outside shut-off conspicuously marked.

Every boiler room or room containing a heating plant shall be separated from the rest of the building with an "Absolute Fire Separation" as specified in Section 503.

**Exceptions and Deviations**

**Sec. 709.** Gymnasiums and similar buildings may have running tracks constructed of wood or unprotected steel or iron.

All partitions and floors in Group B building and all bearing partitions and floors below a Group B occupancy when such occupancy is placed or is to be placed above the first floor of a building or structure shall be of not less than one-hour fire-resistive construction as specified in Chapter 43.

Type IV and V Construction shall not be permitted for use of Group B occupancies.

**Mixed Occupancies**

**Sec. 710.** Separation of Group B occupancies from any other occupancies shall be provided as specified in Section 503.

## CHAPTER 8 — REQUIREMENTS FOR GROUP C BUILDINGS

**Sec. 801.** Each Group C occupancy shall be considered as placed in a separate building and the Group shall include all buildings or portions of buildings used for public gatherings which are not included in Groups A or B, and all school buildings of any kind, and shall have a total seating capacity in any one room of not more than five hundred (500).

### Group C Occupancies Defined

**Sec. 802.** (a) General. Buildings or parts of buildings classed in Group C because of use or the character of the occupancy shall be of Types I, II, III, IV or V Construction and the floor areas shall not exceed those specified in the following table.

### Construction, Height and Area Allowable

**Maximum Allowable Floor Areas as Determined by Height of  
Building, Street Frontage and Type of Construction**

Types of Construction	Maximum Height for Corresponding Areas		Maximum Floor Areas (Sq. Ft.)			
			Building Fronting on			Increase for Complete Sprinkling*
	Feet	Stories	1 street	2 streets	3 or more streets	
Type I	NO RESTRICTIONS					
Type II	75 ft.	7 stories	12,000	15,000	18,000	66 2-3%
	55 ft.	5 stories	15,000	18,000	20,000	
	65 ft.	1 story	20,000	25,000	30,000	
Type III	55 ft.	5 stories	12,000	15,000	18,000	100 %
	20 ft.	1 story	18,000	22,000	26,000	
Type IV	45 ft.	1 story	15,000	18,000	21,000	66 2-3%
Type V	35 ft.	2 stories	6,000	7,000	8,000	100%
	20 ft.	1 story	8,500	9,500	10,500	

**Note:**—\*Increase shall not be permitted unless the area is entirely protected by an automatic sprinkler installation as specified in Chapter 38.

(b) Special Construction. All public or private school buildings two stories in height shall be of Type III Construction or better and shall have all stairs and corridors of not less than one-hour fire-resistive construction as specified in Chapter 43. All school buildings more than two stories in height shall be of Type I Construction.

**Location on Property**

**Sec. 803.** All Group C buildings shall front directly upon at least one public street not less than twenty (20) feet in width, in which front shall be located the main entrance and exit of such building, or such building may be connected to such street by an entrance passageway as specified in Section 804.

All exterior walls or parts of walls, except on street fronts, of Group C buildings which are less than three (3) feet from adjacent property lines shall have no openings therein and shall be of masonry or reinforced concrete. All openings in exterior walls, except on street fronts, which are less than five (5) feet from adjacent property lines shall be protected by doors or windows of one-hour fire-resistive construction as specified in Section 4304. See Section 504 for regulating adjacent buildings on the same property.

**Stairs and Exits**

**Sec. 804.** Requirements for stairs and exits shall be the same as for Group B buildings as specified in Section 704.

**Light and Ventilation**

**Sec. 805.** All portions of Group C buildings customarily used by human beings shall be provided with light and ventilation, either natural or artificial, as specified in Section 605.

**Enclosure of Vertical Openings**

**Sec. 806.** All vertical openings such as elevator shafts, stair wells and vent shafts which permit the passage of fire or smoke through more than two stories shall be enclosed as specified in Chapter 30.

**Fire Extinguishing Apparatus**

**Sec. 807.** Automatic sprinklers, standpipes and basement pipe inlets shall be installed as and when specified in Chapter 38.

**Special Hazards**

**Sec. 808.** Chimneys and heating apparatus shall conform to the requirements of Chapter 37.

Motion picture machine booths shall conform to the requirements of Chapter 40.

Every boiler room or room containing heating apparatus shall be separated from the rest of the building with an "Absolute Fire Separation" as specified in Section 503.

No inflammable liquids shall be placed, stored or used in any Group C buildings except in small quantities as necessary in laboratories, and such liquids shall be kept in tight or sealed containers when not in actual use.

**Exceptions and Deviations**

**Sec. 809.** Gymnasiums and similar buildings may have running tracks constructed of wood or unprotected steel or iron.

All partitions and floors of Group C buildings when more than one story in height and all bearing partitions and floors below a Group C occupancy when such occupancy is placed or is to be placed above the first floor of a building or structure shall be of not less than one-hour fire-resistive construction as specified in Chapter 43.

Three-story buildings of Type V Construction shall not be permitted for use of Group C occupancies.

**Sec. 810.** Separation of Group C occupancies from any other occupancies shall be provided as specified in Section 503.

**Mixed  
Occupancies**



## CHAPTER 9 — REQUIREMENTS FOR GROUP D BUILDINGS

### Group D Occupancies Defined

**Sec. 901.** Each Group D occupancy shall be considered as a separate building and the Group shall include:

Division 1: Jails, prisons, reformatories, houses of correction, asylums for the insane or feeble-minded, and similar buildings.

Division 2: Hospitals, sanitariums, orphanages, nurseries and similar buildings (accommodating more than six.)

### Construction, Height and Area Allowable

**Sec. 902.** (a) Buildings or parts of buildings classified in Group D because of use or the character of the occupancy shall be of Type I, II, III, IV or V Construction, and the floor areas shall not exceed those specified in the following table.

(b) Special Construction. All Division 1 buildings of Group D shall be of Type I construction throughout and all Division 2 buildings of Group D more than one (1) story in height shall have all floors and partitions of not less than one-hour fire-resistive construction as specified in Chapter 43.

**Maximum Allowable Floor Areas as Determined by Height  
of Building, Street Frontage and Type of Construction**

Types of Construction	Maximum Height for Corresponding Areas		Maximum Floor Areas (Sq. Ft.)			
			Building Fronting on			Increase for Complete Sprinkling*
	Feet	Stories	1 street	2 streets	3 or more streets	
Type I	NO RESTRICTIONS					
Type II	75 ft.	7 stories	12,000	15,000	18,000	100%
	55 ft.	5 stories	15,000	18,000	20,000	
	65 ft.	1 story	20,000	25,000	30,000	
Type III	55 ft.	5 stories	10,000	12,500	15,000	66 2-3%
	20 ft.	1 story	15,000	20,000	25,000	
Type IV	45 ft.	1 story	15,000	20,000	25,000	100%
Type V	20 ft.	1 story	5,000	6,000	7,000	66 2-3%

**Note:—**\*Increase shall not be permitted unless the area is entirely protected by an automatic sprinkler installation as specified in Chapter 38.

**Sec. 903.** All exterior walls or parts of walls, except on street fronts, of Group D buildings which are less than five (5) feet from adjacent property lines shall have no openings therein and shall be of masonry or reinforced concrete. All openings in exterior walls, except on street fronts, which are less than ten (10) feet from adjacent property lines shall be protected by doors or windows of one-hour fire-resistive construction as specified in Section 4304. See Section 504 for regulating adjacent buildings on the same property.

**Location on  
Property**

**Sec. 904.** Not less than two exits shall be provided from each floor in every group D building regardless of the height or area of the building, and additional exits shall be provided as specified in Chapter 33.

**Stairs and  
Exits**

In hospitals or sanitariums, ramps with a slope of not more than one (1) in ten (10) shall be installed instead of stairways or in addition thereto to serve all portions of the building where bed-ridden patients are or may be placed. These ramps shall land at the first or ground floor level at points giving the most direct access practicable to the outer air.

Except in places of detention, exit doors shall not be fastened against exit by any device except self-releasing latches, panic bolts or similar devices which can readily be opened from the inside at all times without the use of keys or any special knowledge or effort.

Smokeproof towers shall be provided as specified in Chapter 33.

**Sec. 905.** All portions of Group D buildings customarily used by human beings shall be provided with light and ventilation by means of windows and/or skylights with an area equal to one-eighth ( $1/8$ ) of the total floor area, or shall be provided with artificial light and a mechanically operated ventilating system. The mechanically driven ventilating system shall supply at least thirty (30) cubic feet of pure air per minute for each occupant thereof in all portions of the building and such system shall be kept continuously in operation during such time as the building is occupied.

**Light and  
Ventilation**

**Sec. 906.** All elevator shafts, vent shafts and other vertical openings shall be enclosed as specified under Types of Construction.

**Enclosure  
of Vertical  
Openings**

**Sec. 907.** Automatic sprinklers, standpipes and basement pipe inlets shall be installed as and when specified in Chapter 38.

**Fire  
Extinguishing  
Apparatus**

**Sec. 908.** Chimneys and heating apparatus shall conform to the requirements of Chapter 37.

**Special  
Hazards**

Motion picture machine booths shall conform to the requirements of Chapter 40.

No storage of volatile inflammable liquids shall be allowed in Group D buildings and the handling of such liquids shall not be permitted in any Group D buildings in quantities of more than one gallon unless such handling complies with the suggested ordinance Regulating the Use, Han-

dling, Storage and Sale of Flammable Liquids and the Products Thereof, adopted by the National Fire Protection Association, May, 1926.

Any gas service to a Group D building shall be provided with an outside shut-off conspicuously marked.

Every boiler room or room containing heating apparatus shall be separated from the rest of the building with an "Absolute Fire Separation" as specified in Section 503.

**Exceptions  
and  
Deviations**

**Sec. 909.** No requirements of this Chapter shall be so construed as to prohibit the construction of cell blocks in jails or prevent the use of any locks or safety devices in buildings where it is necessary to forcibly restrain the inmates.

Two or three story buildings of Type V Construction shall not be permitted for use of Group D occupancies.

**Mixed  
Occupancies**

**Sec. 910.** Separation of Group D occupancies from any other occupancies shall be provided as specified in Section 503.

## CHAPTER 10 — REQUIREMENTS FOR GROUP E BUILDINGS

**Sec. 1001.** Each Group E occupancy shall be considered as a separate building and the Group shall include all industrial or commercial buildings in which the nature of the occupancy creates a serious fire or life hazard, such as:

Division 1: Public garages, paint or petroleum storage, dry cleaning plants, gasoline service stations, paint shops.

Division 2: Planing mills, box factories, woodworking and mattress factories.

Division 3: Storage of hazardous and highly inflammable or explosive materials and/or liquids.

**Note:**—Inflammable liquids shall be deemed to be those with a flash point below 190 degrees Fahrenheit as determined by the closed cup tester.

**Sec. 1002.** (a) General. Buildings or parts of buildings classed in Group E because of use or the character of the occupancy shall be of Type I, II, III, IV or V Construction and the floor areas shall not exceed those specified in the following table.

### Group E Occupancies Defined

### Construction, Height and Area Allowable

**Maximum Allowable Floor Areas as Determined by Height  
of Building, Street Frontage and Type of Construction**

Types of Construction	Maximum Height for Corresponding Areas		Maximum Floor Areas (Sq. Ft.)			
			Building Fronting on			Increase for Complete Sprinkling*
	Feet	Stories	1 street	2 streets	3 or more streets	
Type I	NO RESTRICTIONS					
Type II	75 ft.	7 stories	8,000	10,000	12,000	100%
	55 ft.	5 stories	10,000	12,000	15,000	
	65 ft.	1 story	18,000	22,000	26,000	
Type III	55 ft.	5 stories	8,000	10,000	12,000	66 2-3%
	20 ft.	1 story	12,000	15,000	18,000	
Type IV	45 ft.	1 story	10,000	12,000	15,000	100%
Type V	35 ft.	3 stories	5,000	6,000	7,000	66 2-3%
	20 ft.	1 story	8,000	8,000	10,000	

**Note:**—\*Increase shall not be permitted unless the area is entirely protected by an automatic sprinkler installation as specified in Chapter 38.

**Location on  
Property**

**Sec. 1003.** All exterior walls or parts of walls, except on street fronts, of Group E buildings which are less than five (5) feet from adjacent property lines shall have no openings therein and shall be of masonry or reinforced concrete. All openings in exterior walls, except on street fronts, which are less than ten (10) feet from adjacent property lines shall be protected by doors or windows of one-hour fire-resistive construction as specified in Section 4304. See Section 504 for regulating adjacent buildings on the same property.

**Stairs and  
Exits**

**Sec. 1004.** All Group E buildings shall have not less than two means of egress from each story including basements or cellars unless such basements or cellars are used for heating apparatus only, in which latter case only one exit shall be required.

All stairs and exits shall comply with the requirements specified in Chapter 33.

Smokeproof towers shall be installed as and when specified in Chapter 33.

Where ramps are used for the transfer of automobiles from one floor to another such ramps shall meet the ground floor level at a point not less than twenty (20) feet from the exit from such building.

**Light,  
Ventilation  
and  
Sanitation**

**Sec. 1005.** All portions of Group E buildings customarily used by human beings shall be provided with light and ventilation by means of windows and/or skylights with an area equal to one-eighth ( $\frac{1}{8}$ ) of the total floor area or shall be provided with artificial light and mechanically operated ventilating system. The mechanically driven ventilating system shall supply at least thirty (30) cubic feet of pure air per minute for each occupant thereof in all portions of the building and such system shall be kept continuously in operation during such time as the building is occupied.

In all buildings used for the storing or handling of automobiles operated under their own power and in all buildings where inflammable liquids are used exhaust ventilation shall be provided sufficient to produce one complete change of air every fifteen minutes. Such exhaust ventilation shall be taken from a point at or near the floor level.

All buildings where more than four persons are employed shall be provided with at least one toilet. All buildings and each subdivision thereof where both sexes are employed shall be provided with access to at least two toilets either located in such building or conveniently located in a building adjacent thereto.

**Sec. 1006.** All elevator shafts, vent shafts and other vertical openings shall be enclosed as specified under Types of Construction.

Doors which are part of an automobile ramp enclosure may be kept normally open but shall be equipped with fusible links and so arranged as to be self-closing when released.

**Sec. 1007.** Automatic sprinklers, standpipes and basement pipe inlets shall be installed as and when specified in Chapter 38.

**Sec. 1008.** Chimneys and heating apparatus shall conform to the requirements of Chapter 37, except that no open flame nor any heater with an enclosed flame shall be installed or maintained in any garage, dry cleaning establishment or place of storage of volatile or inflammable liquids.

In dry cleaning establishments the walls of the cleaning rooms or room in which volatile inflammable liquids are used shall have vent holes at the floor line not less than sixteen (16) square inches in area placed not more than sixteen (16) feet apart at or near the floor line, properly protected by iron bars or screens; or such room may be equipped with exhaust ventilation sufficient to cause a complete change of air four times an hour with exhaust duct openings located at or near the floor line.

The use, handling, storage and sale of gasoline, fuel oil and other inflammable liquids shall not be permitted in any Group E building unless such use, handling, storage and sale complies with the suggested ordinance Regulating the Use, Handling Storage and Sale of Flammable Liquids and the Products Thereof, adopted by the National Fire Protection Association, May, 1926.

All doors leading into rooms in which volatile inflammable liquids are used shall be of not less than one-hour fire-resistive construction as specified in Section 4304 and kept normally closed but shall be equipped with fusible links and so arranged as to be self-closing when released.

Each machine in dry cleaning establishments which uses a volatile inflammable liquid shall have an adequate steam line directly connected to it, so arranged as to have the steam automatically released to the inside of such machine should an explosion occur in the machine.

**Sec. 1009.** Public garages, dry cleaning establishments using inflammable liquids and all buildings in which inflammable liquids are used, sold or stored shall not be of Type V Construction, shall not be of Type III construction when more than two (2) stories in height, and shall be not over six hundred (600) square feet in area or twenty-five (25) feet in height when of Type IV construction.

All public garage floors shall be of incombustible materials and if not placed directly on the ground shall conform to the requirements for floors of Type I Construction, or the floors may be of Type II Construction properly protected with incombustible materials against saturation by oil and grease.

**Enclosure  
of Vertical  
Openings**

**Fire  
Extinguishing  
Apparatus**

**Special  
Hazards**

**Exceptions  
and  
Deviations**

## **Secs. 1009-1010**

Gasoline filling stations shall not be of Type V Construction.

Division 3 buildings of Group E more than six (6) stories in height shall have all floors of not less than three-hour fire-resistive construction as specified in Section 4303.

### **Mixed Occupancies**

**Sec. 1010.** Separation of Group E occupancies from all other occupancies shall be provided as specified in Section 503.

## CHAPTER 11 — REQUIREMENTS FOR GROUP F BUILDINGS

**Sec. 1101.** Each Group F occupancy shall be considered as a separate building and the Group shall include all moderately hazardous industrial and commercial occupancies, such as:

Division 1: Wholesale and retail stores, office buildings, restaurants, undertaking parlors, printing plants, municipal police and fire stations.

Division 2: Factories and workshops using materials not highly inflammable or combustible.

Division 3: Storage and sales rooms for combustible goods.

**Sec. 1102.** Buildings or parts of buildings classed in Group F because of use or the character of the occupancy shall be of Types I, II, III, IV or V Construction and the floor areas shall not exceed those specified in the following table.

### Group F Occupancies Defined

### Construction Height and Area Allowable

**Maximum Allowable Floor Areas as Determined by Height  
of Building, Street Frontage and Type of Construction**

Types of Construction	Maximum Height for Corresponding Areas		Maximum Floor Areas (Sq. Ft.)			
			Building Fronting on			Increase for Complete Sprinkling*
	Feet	Stories	1 street	2 streets	3 or more streets	
Type I	NO RESTRICTIONS					
Type II	75 ft.	7 stories	12,000	15,000	18,000	100%
	55 ft.	5 stories	15,000	18,000	20,000	
	65 ft.	1 story	20,000	25,000	30,000	
Type III	55 ft.	5 stories	12,000	15,000	18,000	66 2-3%
	20 ft.	1 story	18,000	22,500	25,000	
Type IV	45 ft.	1 story	20,000	25,000	30,000	66 2-3%
Type V	35 ft.	3 stories	5,000	6,000	7,000	66 2-3%
	20 ft.	1 story	10,000	12,000	14,000	

**Note:—**\*Increase shall not be permitted unless the area is entirely protected by an automatic sprinkler installation as specified in Chapter 38.

**Sec. 1103.** All exterior walls or parts of walls, except on street fronts, of Group F buildings which are less than four (4) feet from adjacent property lines shall have no openings therein and shall be of masonry or reinforced concrete. All openings in exterior walls, except on street fronts, which are less than eight (8) feet from adjacent property lines shall be protected by doors or windows of one-hour fire-resistive construction as specified in

### Location on Property



Section 4304. See Section 504 for regulating adjacent buildings on the same property.

**Stairs and Exits**

**Sec. 1104.** Stairs and exits shall comply with the requirements specified in Chapter 33.

Smokeproof towers shall be provided as and when specified in Chapter 33.

**Light, Ventilation and Sanitation**

**Sec. 1105.** All portions of Group F buildings customarily used by human beings shall be provided with light and ventilation by means of windows and/or skylights with an area not less than one-eighth ( $1/8$ ) of the total floor area or shall be provided with artificial light and a mechanically operated ventilating system. In no case shall less than four changes of air per hour be provided.

Every building or portion thereof where more than four persons are employed shall be provided with at least one toilet. Every building and each subdivision thereof where both sexes are employed shall be provided with access to at least two toilets either located in such building or conveniently located in a building adjacent thereto.

**Enclosure of Vertical Openings**

**Sec. 1106.** All elevator shafts, vent shafts and other vertical openings shall be enclosed as specified under Types of Construction.

**Fire Extinguishing Apparatus**

**Sec. 1107.** Automatic sprinklers, standpipes and basement pipe inlets shall be installed as and when specified in Chapter 38.

**Special Hazards**

**Sec. 1108.** Chimneys and heating apparatus shall conform to the requirements of Chapter 37

No storage of volatile inflammable liquids shall be allowed in Group F buildings and the handling and use of gasoline, fuel oil and other inflammable liquids shall not be permitted in any Group F building unless such use and handling complies with the suggested ordinance Regulating the Use, Handling, Storage and Sale of Flammable Liquids and the Products Thereof, adopted by the National Fire Protection Association, May, 1926.

**Exceptions and Deviations**

**Sec. 1109.** Roof covering on Type V buildings may be of galvanized iron or sheet metal laid directly on the wood roof framing without solid sheathing.

Division 3 buildings of Group F more than six (6) stories in height shall have all floors of not less than three-hour fire-resistive construction as specified in Section 4303.

**Mixed Occupancies**

**Sec. 1110.** Separation of Group F occupancies from all other occupancies shall be provided as specified in Section 503.

## CHAPTER 12 — REQUIREMENTS FOR GROUP G BUILDINGS

**Sec. 1201.** Each Group G occupancy shall be considered as a separate building and the Group shall include non-hazardous industrial and commercial occupancies which create a low fire and life hazard, such as:

Division 1: Ice plants, power plants, pumping plants, cold storage, creameries.

Division 2: Factories and workshops using incombustible and/or non-explosive materials.

Division 3: Storage and sales rooms of incombustible and/or non-explosive materials.

**Group G  
Occupancies  
Defined**

**Sec. 1202.** Buildings or parts of buildings classed in Group G because of use or the character of the occupancy shall be of Types I, II, III, IV or V Construction and the floor areas shall not exceed those specified in the following table.

**Construction  
Height and  
Area  
Allowable**

**Maximum Allowable Floor Areas as Determined by Height  
of Building, Street Frontage and Type of Construction**

Types of Construction	Maximum Height for Corresponding Areas		Maximum Floor Areas (Sq. Ft.)			
			Building Fronting on			Increase for Complete Sprinkling*
	Feet	Stories	1 street	2 streets	3 or more streets	
Type I	NO RESTRICTIONS					
Type II	75 ft.	7 stories	15,000	18,000	20,000	100%
	55 ft.	5 stories	20,000	25,000	30,000	
	65 ft.	1 story	UNRESTRICTED			
Type III	55 ft.	5 stories	12,000	15,000	18,000	66 2-3%
	20 ft.	1 story	20,000	25,000	30,000	
Type IV	45 ft.	1 story	25,000	30,000	35,000	100%
Type V	35 ft.	3 stories	10,000	12,500	15,000	66 2-3%
	20 ft.	1 story	12,000	15,000	18,000	

**Note:**—\*Increase shall not be permitted unless the area is entirely protected by an automatic sprinkler installation as specified in Chapter 38.

**Sec. 1203.** All exterior walls or parts of walls, except on street fronts, of Group G buildings which are less than three (3) feet from adjacent property lines shall have no openings therein and shall be of not less than masonry or

**Location  
Property**

## **Secs. 1203-1210**

reinforced one-hour fire-resistive construction as specified in Section 4304. See Section 504 for regulating adjacent buildings on the same property.

### **Stairs and Exits**

**Sec. 1204.** Stairs and exits shall be provided as specified in Chapter 33. Smokeproof towers shall be provided as and when required in Chapter 33.

### **Light, Ventilation and Sanitation**

**Sec. 1205.** All portions of Group G buildings customarily used by human beings shall be provided with light and ventilation

Every building or portion thereof where more than four persons are employed shall be provided with at least one toilet. Every building and each subdivision thereof where both sexes are employed shall be provided with access to at least two toilets either located in such building or conveniently located in a building adjacent thereto.

### **Enclosure of Vertical Openings**

**Sec. 1206.** Except as specified in Chapter 33, vertical openings are not required to be enclosed.

### **Fire Extinguishing Apparatus**

**Sec. 1207.** Automatic sprinklers, standpipes and basement pipe inlets shall be installed as and when specified in Chapter 38.

### **Special Hazards**

**Sec. 1208.** Chimneys and heating apparatus shall conform to the requirements of Chapter 37.

The storage, use and handling of gasoline, fuel oil and other inflammable liquids shall not be permitted in any Group G building unless such storage and handling complies with the suggested ordinance Regulating the Use, Handling, Storage and Sale of Flammable Liquids and the Products Thereof, adopted by the National Fire Protection Association, May, 1926.

### **Exceptions and Deviations**

**Sec. 1209.** Roof covering on Type V buildings may be of galvanized iron or sheet metal laid directly on the wood roof framing without solid sheathing. Fireproofing of the underside of all roof framing of Group G buildings may be omitted in all Types of Construction.

### **Mixed Occupancies**

**Sec. 1210.** Separation of Group G occupancies from all other occupancies shall be provided as specified in Section 503.

## CHAPTER 13 — REQUIREMENTS FOR GROUP H BUILDINGS

**Sec. 1301.** Each Group H occupancy shall be considered as a separate building and the Group shall include:

Division 1: Hotels, apartment houses, dormitories, lodging houses.

Division 2: Convents, monasteries, old people's homes (accommodating ten or more persons).

**Sec. 1302.** Buildings or parts of buildings classed in Group H because of use or the character of the occupancy shall be of Types I, II, III, IV or V Construction and the floor areas shall not exceed those specified in the following table.

**Group H  
Occupancies  
Defined**

**Construction  
Height and  
Area  
Allowable**

**Maximum Allowable Floor Areas as Determined by Height  
of Building, Street Frontage and Type of Construction**

Types of Construction	Maximum Height for Corresponding Areas		Maximum Floor Areas (Sq. Ft.)			Increase for Complete Sprinkling*
			Building Fronting on			
	Feet	Stories	1 street	2 streets	3 or more streets	
Type I	NO RESTRICTIONS					
Type II	75 ft.	7 stories	12,000	15,000	18,000	100%
	55 ft.	5 stories	15,000	18,000	20,000	
	65 ft.	1 story	20,000	25,000	30,000	
Type III	55 ft.	5 stories	12,000	15,000	18,000	66 2-3%
	20 ft.	1 story	18,000	20,000	22,500	
Type IV	45 ft.	1 story	15,000	18,000	22,500	100%
Type V	35 ft.	3 stories	6,000	7,000	8,000	66 2-3%
	20 ft.	1 story	8,000	9,000	10,000	

**Note:—**\*Increase shall not be permitted unless the area is entirely protected by an automatic sprinkler installation as specified in Chapter 38.

**Sec. 1303.** All exterior walls or parts of walls, except on street fronts, of Group H buildings which are less than three (3) feet from adjacent property lines shall have no openings therein and shall be of not less than one-hour fire-resistive construction as specified in Section 4304. All openings in exterior walls, except on street fronts, which are less than five (5) feet from adjacent property lines shall be protected by doors or windows of one-hour

**Location on  
Property**

fire-resistive construction as specified in Section 4304. See Section 504 for regulating adjacent buildings on the same property.

Location of Group H buildings on the property shall meet the requirements of the ..... Housing Act of the ..... of ..... (See Appendix.)

**Stairs and Exits**

**Sec. 1304.** Stairs and exits shall be provided as specified in Chapter 33.

Smokeproof towers shall be provided as and when specified in Chapter 33.

All stairs and exits in Group H buildings shall open directly upon a street or alley or upon a yard or court not less than five (5) feet in width directly connected to a street or alley by means of a passageway not less in width than the stairway opening into such passageway and not less than seven (7) feet in height.

**Light, Ventilation and Sanitation**

**Sec. 1305.** All portions of Group I buildings used for eating, living and/or sleeping purposes shall be provided with light and ventilation by means of windows with an area not less than one-eighth ( $\frac{1}{8}$ ) of the total floor area of any room or rooms.

Every building shall be provided with at least one toilet. Every building and each subdivision thereof where both sexes are accommodated shall be provided with at least two toilets located in such building and one toilet shall be conspicuously marked "For Women" and the other conspicuously marked "For Men." Not less than one toilet shall be provided for each fifteen (15) persons or major fraction thereof that such building is designed to accomodate.

Light, ventilation and sanitation shall be provided as specified by the ..... Housing Act of the ..... of .....

**Enclosure of Vertical Openings**

**Sec. 1306.** All elevator shafts, vent shafts, stairways and other vertical openings shall be enclosed as specified under Types of Construction.

**Fire Extinguishing Apparatus**

**Sec. 1307.** Automatic sprinklers, standpipes and basement pipe inlets shall be installed as and when specified in Chapter 38.

**Special Hazards**

**Sec. 1308.** Chimneys and heating apparatus shall conform to the requirements of Chapter 37.

Every boiler room or room containing a central heating plant using solid or liquid fuel shall be separated from the rest of the building by a "Special Fire Separation" as specified in Section 503; except, that in buildings of Type V Construction an "Ordinary Fire Separation" may be used.

The storage and handling of gasoline, fuel oil and other inflammable liquids shall not be permitted in any Group H building unless such storage and handling complies with the suggested ordinance Regulating the Use, Handling, Storage and Sale of Flammable Liquids and the Products

Thereof, adopted by the National Fire Protection Association, May, 1926. All doors leading into rooms in which volatile inflammable liquids are used or kept shall be of one-hour fire-resistive construction as specified in Section 4304 and shall be kept normally closed.

**Sec. 1309.** The partitions forming separations between adjoining apartments shall be of not less than one-hour fire-resistive construction as specified in Section 4302.

Furnaces may be used without a "Fire Separation" in buildings not more than two (2) stories in height.

**Sec. 1310.** Separations between Group H occupancies from all other occupancies shall be provided as specified in Section 503.

**Exceptions  
and  
Deviations**

**Mixed  
Occupancies**

## CHAPTER 14 — REQUIREMENTS FOR GROUP I BUILDINGS

<b>Group I Occupancies Defined</b>	<b>Sec. 1401.</b> Each Group I occupancy shall be considered as a separate building and the Group shall include any buildings or parts of buildings used as dwellings.
<b>Construction Height and Area Allowable</b>	<b>Sec. 1402.</b> Buildings or parts of buildings classed in Group I because of use or the character of the occupancy shall be of Types I, II, III, IV or V Construction. The floor areas of Types I and II shall be unlimited, the floor area of Types III and IV shall be limited to ten thousand (10,000) square feet, and the floor-area of Type V shall be limited to seventy-five hundred (7,500) square feet.
<b>Location on Property</b>	<b>Sec. 1403.</b> All exterior walls or parts of walls, except on street fronts, of Group I buildings which are less than three (3) feet from adjacent property lines shall have no openings therein and shall be of not less than one-hour fire-resistive construction as specified in Section 4304. All openings in exterior walls, except on street fronts, which are less than four (4) feet from adjacent property lines shall be protected by metal-clad doors and wire glass windows with metal covered sash and frame. See Section 504 for regulating adjacent buildings on the same property.
<b>Stairs and Exits</b>	<b>Sec. 1404.</b> Stairs and exits shall be provided as and when specified in Chapter 33.
<b>Light, Ventilation and Sanitation</b>	<p><b>Sec. 1405.</b> All portions of Group I buildings used for eating, living and/or sleeping purposes shall be provided with light and ventilation by means of windows with an area not less than one-eighth (<math>\frac{1}{8}</math>) of the total floor area of any room or rooms.</p> <p>Light, ventilation and sanitation shall be provided as specified by the ..... Housing Act of the ..... of .....</p>
<b>Enclosure of Vertical Openings</b>	<b>Sec. 1406.</b> Stairs in Group I buildings need not be enclosed. Dumb-waiter shafts, clothes chutes and other similar vertical openings shall be protected as specified in Section 3003.
<b>Fire Extinguishing Apparatus</b>	<b>Sec. 1407.</b> Fire extinguishing apparatus when installed shall conform to the requirements of Chapter 38.
<b>Special Hazards</b>	<p><b>Sec. 1408.</b> Chimneys and heating apparatus shall conform to the requirements of Chapter 37.</p> <p>Inflammable liquids shall not be stored or used in Group I buildings in quantities in excess of one (1) gallon and all such inflammable liquids shall be kept in tight or sealed containers when not in actual use.</p>

**Sec. 1409.** Dwellings constructed on the roof of multiple storied buildings shall be considered as an additional story in so far as the construction, location, exposure, stairs, exits and fire extinguishing apparatus is concerned.

**and Devia-  
Exceptions  
tions**

**Sec. 1410.** Separation of Group I occupancies from all other occupancies shall be provided as specified in Section 503.

**Mixed  
Occupancies**



**CHAPTER 15 — REQUIREMENTS FOR  
GROUP J BUILDINGS**

**Group J  
Buildings  
Defined**

**Sec. 1501.** Each Group J building or occupancy shall be considered as a separate building and the Group shall include:

Division 1: Private garages.

Division 2: Accessory buildings and structures such as tents, sheds, fences over six feet high, water tanks, towers.

Division 3: Stadiums, reviewing stands and amusement park structures.

**Construction  
Height and  
Area  
Allowable**

**Sec. 1502.** Buildings or parts of buildings classed in Group J because of use or the character of the occupancy shall be of Types I, II, III, IV or V Construction as regulated by the requirements of Chapter 16. The floor area of Types I and II construction shall not be limited, the floor area of Types III and IV shall be limited to ten (10) square feet and buildings of Type V construction shall not exceed one thousand (1000) square feet in area and/or two (2) stories in height, except that such restriction of Type V construction shall not apply to stadiums, reviewing stands or amusement park structures of the open skeleton-framed type.

Reviewing stands and amusement park structures shall be designed and constructed in a substantial manner so as to fully withstand all impact loads in addition to the static loads specified in Chapter 23. (See Appendix).

**Location on  
Property**

**Sec. 1503.** All exterior walls or parts of walls, except on street fronts, of Group J buildings which are less than three (3) feet from adjacent property lines shall have no openings therein and shall be of not less than one-hour fire-resistive construction as specified in Section 4304. See Section 504 for regulating adjacent buildings on the same property.

**Stairs,  
Exits, Aisles  
and Seats**

**Sec. 1504.** (a) Stairs and exits for amusement park devices shall be provided as specified in Chapter 33 except that stairs and ramps in buildings not exceeding two stories in height need not be enclosed.

(b) Stairs, exits, aisles and seating for stadiums and reviewing stands shall be as follows:

1. Stairs. All stairs shall have a rise of not more than seven and one-half (7½) inches and a tread of not less than ten (10) inches not including the nosing.

2. Exits. There shall be provided one exit not less than seven (7) feet wide for each two thousand (2000) persons or major fraction thereof which the stadium or reviewing stand is designed to seat. Such exits shall be spaced not more than seventy-five (75) feet apart. Passageways serving such exits shall be not less than seven (7) feet in clear height nor less than seven (7) feet in clear width.

3. Aisles. Aisles not less than three feet six inches (3' 6") in width shall be provided so that there are not more than twenty (20) seats between any seat and an aisle.

**4. Seats.** Where seats are not spaced or marked off in any stadium or reviewing stand, a distance of eighteen (18) inches along any bench or platform shall constitute one seat in computing the required aisles, stairs and exits. Seats shall be spaced not less than twenty-six (26) inches back to back and where backs are provided for the seats they shall be spaced thirty (30) inches back to back.

Where the space under the stadium or reviewing stand is used for any purpose whatsoever, exits passing through this space shall be separated therefrom by walls, floors and ceilings of not less than one-hour fire-resistive construction.

**Sec. 1505.** Private garages which are constructed in conjunction with any Group H or I buildings and which have openings into such buildings shall be equipped with fixed louvered or screened openings or exhaust ventilation with exhaust openings located within six (6) inches of the floor. The clear area of the louvered openings or of the openings into the exhaust ducts shall be not less than sixty (60) square inches per car stored in such private garage. Under no circumstances shall a private garage have any opening into a living or sleeping room.

Amusement park structures which have enclosed spaces open to and used by the public shall be provided with light and ventilation, either natural or artificial, sufficient for safe and healthful conditions.

**Sec. 1506.** Elevator shafts, vent shafts, stair-wells and similar vertical openings shall be enclosed as specified in Chapter 30 when extending through three or more stories.

**Sec. 1507.** Fire extinguishing apparatus shall be installed as and when specified in Chapter 38.

Where more than three automobiles are stored in any private garage there shall be installed not less than one two-and-one-half (2 1/2) gallon chemical extinguisher to each five cars or major fraction thereof.

**Sec. 1508.** Chimneys and heating apparatus shall conform to the requirements of Chapter 37.

Inflammable liquids shall not be stored, handled or used in Group J buildings unless such storage or handling shall comply with the suggested ordinance. Regulating the Use, Handling, Storage and Sale of Flammable Liquids and the Products Thereof, adopted by the National Fire Protection Association, May, 1926.

**Sec. 1509.** When space, termed by this Code a private garage, is designed and provided for the storage of more than ten (10) automobiles, such space shall be separated from the rest of the building by an "Absolute Fire Separation" as specified in Section 503 and shall be deemed to be a public garage.

Amusement park structures into which the public is admitted, other than those of the open frame type of construction when more than one story or

**Light and  
Ventilation**

**Enclosure  
of Vertical  
Openings**

**Fire  
Extinguishing  
Apparatus**

**Special  
Hazards**

**Exceptions  
and  
Deviations**

**Secs. 1509-1510**

two hundred (200) square feet in area shall have the exterior walls, bearing partitions and floors of not less than one-hour fire-resistive construction as specified in Chapter 43.

**Mixed  
Occupancies**

**Sec. 1510.** Separation of Group J occupancies from any other occupancies shall be provided as specified in Section 503 and in Section 1509.

## PART IV.

## REQUIREMENTS BASED ON LOCATION IN FIRE ZONES

### CHAPTER 16 — RESTRICTIONS IN FIRE ZONES

**Sec. 1601.** For the purpose of this Code, the entire City of ..... is hereby declared to be and is hereby established a Fire District and said Fire District shall be known and designated as Fire Zones One, Two, Three and Four, and shall include such territory or portions of said city as outlined in an ordinance of said city, entitled, "An Ordinance Creating and Establishing Fire Zones in the City of .....". Wherever in such ordinance creating and establishing fire zones, reference is made to any fire zone, it shall be construed to mean one of the four fire zones designated and referred to in this Chapter. (See Appendix.)

#### Fire Zones Defined

**Sec. 1602.** (a) No building or structure of Type V Construction shall be erected or constructed in or moved into Fire Zone No. 1.

#### Restrictions in Fire Zone No. 1

(b) No building or structure of Type IV Construction having an area greater than four hundred (400) square feet shall be erected or constructed in or moved into Fire Zone No. 1.

(c) Any building or structure in Fire Zone No. 1 which is enlarged, altered, raised or built upon to an extent exceeding an expenditure of twenty (20) per cent of the value of such building, shall be made to completely comply with the requirements of a Type I, II or III building.

(d) Any building or structure moved into Fire Zone No. 1 shall comply with all the requirements for new buildings in Fire Zone No. 1.

(e) No building of Type IV Construction in excess of four hundred (400) square feet in area nor any building of Type V Construction already erected in Fire Zone No. 1 shall hereafter be altered, raised, enlarged, added to or moved, except as follows:

(1) Such building may be entirely demolished.

(2) Such building may be moved entirely outside the limits of Fire Zone No. 1.

(3) Changes, alterations and repairs to the interior of such building or to the front facing a public street may be made, provided such changes shall not increase in the opinion of the Building Inspector, the fire hazard of such building.

(4) Roofs of such buildings may be covered only with a "Fire-Retardant" roof as specified in Section 4305.

(f) Temporary buildings such as reviewing stands and other miscellaneous structures conforming to the requirements of this Code, and sheds, canopies or fences used for the protection of the public around and in conjunction with construction work may be erected in Fire Zone No. 1 by

special permit from the Building Inspector for a limited period of time and such structures shall be completely removed upon the expiration of the time limit in such permit.

(g) All doors, windows and other openings in exterior walls of all buildings erected in Fire Zone No. 1 shall be protected by doors or windows of one-hour fire-resistive construction as specified in Section 4304.

Exceptions: The provisions of paragraph (g) shall not apply to doors, windows or other openings which face directly upon and are not within fifty (50) feet of the opposite side of a public street or other public place, this distance to be measured at right angles to the plane of the wall in which such openings occur.

The provisions of paragraph (g) shall not apply to openings in an outer court twenty (20) feet or more in width parallel to and facing upon a street or public place, provided such openings are not within twenty (20) feet of an adjacent property line.

(h) All buildings of Type III construction erected in Fire Zone No. 1 shall have all partitions and floors of not less than one-hour fire-resistive construction as specified in Chapter 43.

(i) No Group E buildings except public garages or gasoline filling stations shall be constructed or erected in Fire Zone No. 1 and no existing buildings shall be used or occupied in any manner whatsoever by Group E occupancies except as public garages or gasoline filling stations.

**Restrictions  
in Fire Zone  
No. 2**

**Sec. 1603.** (a) Buildings of Type V Construction erected or constructed in Fire Zone No. 2 shall have all exterior walls of not less than one-hour fire-resistive construction as specified in Section 4302; provided, that when such exterior walls are less than three (3) feet from adjacent property lines or less than six (6) feet from buildings on the same property the exterior walls shall be of masonry and in both cases the roofs of such buildings shall be covered with a "Fire-Retardant" roofing as specified in Section 4305.

(b) No building of Type IV Construction having an area greater than one thousand (1000) square feet shall be erected or constructed in Fire Zone No. 2

(c) Any building in Fire Zone No. 2 which is enlarged, altered, rasied or built upon to an extent exceeding an expenditure of fifty (50) per cent of the value of such building shall be made to comply with the requirements of a Type I, II, III, IV or V building.

(d) Any building or structure moved into Fire Zone No. 2 shall comply with all the requirements for new buildings in Fire Zone No. 2.

(e) No building of Type IV Construction in excess of one thousand (1000) square feet in area, nor any building of Type V Construction, except as noted in paragraph (a) of this Section, already erected in Fire Zone No. 2 shall hereafter be altered, rasied, enlarged, added to or moved except as follows:

(1) Such building may be entirely demolished.

(2) Such building may be moved entirely outside the limits of Fire Zone No. 2.

(3) Such building may be made to conform to the provisions of paragraph (a) of this Section.

(4) Changes, alterations and repairs to the interior of such building or to the front facing a public street may be made provided such changes do not increase the fire hazard of such building.

(5) Roofs of such buildings may be covered only with a "Fire-Retardant" roof as specified in Section 4305.

(f) Temporary buildings such as reviewing stands and other miscellaneous structures conforming to the requirements of this Code, and sheds, canopies or fences used for the protection of the public around and in conjunction with construction work may be erected in Fire Zone No. 2 by special permit from the Building Inspector for a limited period of time and such structures shall be completely removed upon the expiration of the time limit in such permit.

(g) No Group E buildings except public garages or gasoline filling stations shall be constructed or erected in Fire Zone No. 2 and no existing buildings shall be used or occupied in any manner whatsoever by Group E occupancies except as public garages or gasoline filling stations.

**Sec. 1604.** Any building complying with the requirements specified in this Code may be erected in Fire Zone No. 3.

**Restrictions  
in Fire Zone  
No. 3**

**Sec. 1605.** (a) No building or structure of Type V Construction shall be erected in Fire Zone No. 4 with an area in excess of four thousand (4000) square feet.

**Restrictions  
in Fire Zone  
No. 4**

(b) Any building in Fire Zone No. 4 which is enlarged, altered, raised or built upon to an extent exceeding an expenditure of fifty (50) per cent of the value of such structure shall be made to comply with the requirements of a Type I, II, III, IV or V buildings except that floors in the first story of such buildings need not comply with such requirements.

(c) Any building or structure moved into Fire Zone No. 4 shall comply with all requirements for new buildings in Fire Zone No. 4.

(d) Buildings of Type V Construction may be built in excess of four thousand (4000) square feet providing such buildings are divided by "Special Fire Separation" as specified in Section 503, into areas not exceeding four thousand (4000) square feet.

**PART V.**  
**REQUIREMENTS BASED ON TYPES**  
**OF CONSTRUCTION**

**CHAPTER 17 — CLASSIFICATION OF ALL BUILDINGS**  
**BY TYPES OF CONSTRUCTION**

**General**

**Sec. 1701.** The requirements of Part V are the minimum requirements for the various Types of Construction. In order that a building may be classed in any specific Type of Construction it is necessary that all of the requirements for that Type of Construction be complied with.

No building or portion thereof shall be required to conform to the details of a Type of Construction higher than that Type which meets the minimum requirements based on Occupancy (Part III) or Location in Fire Zone (Part IV) even though certain features of such building actually conform to a higher Type of Construction. (See Appendix).

The various Types of Construction herein specified represent varying degrees of public safety and resistance to fire. Where specific materials, types of construction or fire-resistive protection are required, such requirements shall be the minimum requirements and any materials, types of construction or fire-resistive protection which will afford equal or greater public safety or resistance to fire, as specified in this Code, may be used.

Any system or method of construction to be used shall admit of a rational analysis in accordance with well established principles of mechanics.

**Classification  
by Types of  
Construction**

**Sec. 1702.** All buildings for the purpose of this Code shall be divided into the following Types of Construction based upon their resistance to fire, and for the purpose of this Code Type I shall be deemed to be the most fire-resistive and Type V the least fire-resistive Type of Construction.

Type I—FIRE-RESISTIVE Construction.

Type II—HEAVY TIMBER Construction.

Type III—ORDINARY MASONRY Construction.

Type IV—METAL FRAME Construction.

Type V—WOOD FRAME Construction.

When two or more types of construction occur in the same building and are not separated by an "Absolute Fire Separation" as specified in Section 503, the entire building shall be classed in the least fire-resistive type of construction and such building shall be subject to the restrictions of such type. Any building erected prior to the passage of this Code, which by its construction cannot be definitely classified as Type I, II, III, IV or V as defined herein, shall for the purpose of this Code be deemed to belong to the least fire-resistive class of the two types to which it most nearly conforms.

For these determinations Type I shall be considered the most fire-resistive and Type V the least fire-resistive Types of Construction.

**CHAPTER 18 — TYPE I BUILDINGS****(Fire-Resistive)**

**Sec. 1801.** "Type I" or "Type I Buildings". The structural frame of Type I buildings shall be of structural steel or iron which shall be fire-proofed, or shall be of reinforced concrete. The foundation, exterior walls and inner court walls shall be of masonry or reinforced concrete. The roof construction, floors and partitions shall be of fire-resistive materials. Exterior doors and windows, except as specified in Section 1813 shall be of fire-resistive construction. (Note: Fire-resistive materials and fire-resistive construction have a specific meaning in this Code, as specified in Chapters 42 and 43.)

**Definition**

**Sec. 1802.** The height of Type I buildings shall not be limited. (See Appendix.)

**Height Allowable**

**Sec. 1803.** The floor area of Type I buildings shall not be limited.

**Area Allowable**

**Sec. 1804.** Foundation walls and footings shall be of solid masonry as specified in Chapter 29 or of reinforced concrete as specified in Chapters 26 and 29, and shall be proportioned as specified in Sections 2306 and 2802.

**Foundations**

**Sec. 1805.** All exterior walls, fire walls and fire division walls shall be of masonry or reinforced concrete as specified in Chapter 29 and shall be of not less than four-hour fire-resistive construction as specified in Section 4302.

**Exterior and Inner Court Walls**

Inner court walls shall be of masonry or reinforced concrete of not less than three-hour fire-resistive construction as specified in Section 4302.

**Sec. 1806.** Interior partitions shall be constructed of incombustible materials and shall be of not less than one-hour fire-resistive construction as specified in Section 4302.

**Partitions**

Exceptions: Partitions dividing portions of stores, offices or similar places occupied by one tenant only may be constructed of wood panels or similar light construction up to three-fourths ( $\frac{3}{4}$ ) the height of the room in which placed; when more than three-fourths ( $\frac{3}{4}$ ) the height of the room, such partitions shall have not less than the upper one-fourth ( $\frac{1}{4}$ ) of the partition constructed of glass set in sash.

**Sec. 1807.** Enclosures for elevator shafts, vent shafts, stair wells and other vertical openings, when required because of Occupancy in Part III shall be of two-hour fire-resistive construction and all openings therein shall be protected by fire-resistive doors or windows as specified in Chapters 30 and 43.

**Enclosure of Vertical Openings**

A parapet wall or hand rail at least thirty (30) inches in height above the roof shall be provided around all open shaft enclosures extending through the roof.

**Sec. 1808.** Structural framework shall be of structural steel or iron as specified in Chapter 27 or shall be of reinforced concrete as specified in Chapter 26.

**Structural Framework**

The structural frame shall be considered as the columns, and all girders, beams, trusses or spandrels having rigid connections to the columns. The



members of floor or roof panels which have no connection to the columns, shall be considered secondary members. The structural frame and secondary members shall be designed and constructed to carry all dead, live and other loads to which they may be subjected both during erection and after completion of the structure. Unless otherwise provided for in the structural frame the floor and roof panel construction shall be designed and constructed to carry the horizontal force to such parts of the structural frame as are designed to carry the horizontal forces to the foundations.

The entire structural frame and each member which is a part of such frame shall be so designed and constructed that the stresses may be satisfactorily determined by a rational analysis in accordance with well established principles of mechanics and sound engineering practice.

**Fireproofing  
of  
Structural  
Members**

**Sec. 1809.** (a) All structural steel or iron members, not including forms or structural members for elevators and elevator enclosures, shall be thoroughly fire-proofed with not less than four-hour fire-resistive protection for columns, beams and girders and three-hour fire-resistive protection for floors, for all buildings more than eight (8) stories or eighty-five (85) feet in height; and with three-hour fire-resistive protection for columns, beams and girders and two-hour fire-resistive protection for floors for all buildings which are eight (8) stories or eighty-five (85) feet or less in height; and all such fire-resistive protection shall be as specified in Chapter 43.

Exceptions: (1) The thickness of the fireproofing on the outer edge of lugs or brackets on columns may be reduced to not less than one (1) inch.

(2) The masonry over window openings may be supported by a steel plate, angle or similar member which is not fireproofed on the under side, provided the member is supported at proper intervals from a structural beam or girder which is fireproofed on all sides. For openings in masonry bearing walls not exceeding four (4) feet in width, an angle or similar member supported by masonry and not fireproofed on the under side may be used.

(3) Where every part of the structural steel framework of the roof of a Group A, B or C building is not less than twenty-five (25) feet above any floor or balcony, fireproofing of all members of the roof construction may be omitted.

(4) Where every part of the structural steel framework of the roof of a Group A, B or C building is more than eighteen (18) feet and less than twenty-five (25) feet above any floor or balcony the roof construction shall be protected by a suspended ceiling of not less than two-hour fire-resistive construction as specified in Chapter 43, and such ceiling shall be not less than six (6) inches distant from any part of such roof construction.

(b) All reinforced concrete columns, beams and girders shall be thoroughly fireproofed with four-hour fire-resistive protection and all floors, joists and slabs shall be thoroughly fireproofed with not less than three-hour fire-resistive protection for all buildings more than eight (8) stories or eighty-five (85) feet in height; and all reinforced concrete columns, beams

and girders shall be thoroughly fireproofed with not less than three-hour fire-resistive protection and all floors, joists and slabs shall be thoroughly fireproofed with not less than two-hour fire-resistive protection for all buildings which are eight (8) stories or eighty-five (85) feet or less in height; and all such fire-resistive protection shall be as specified in Chapter 43.

**Sec. 1810.** Floors shall be constructed of reinforced concrete, brick or hollow tile arches, reinforced gypsum or may be composite floors of those materials in combination with structural steel or iron or reinforced concrete or such floor panel construction shall consist of any floor system providing not less than two-hour fire-resistive construction as specified in Section 4304 for buildings which are eight (8) stories or eighty-five (85) feet or less in height and providing not less than three-hour fire-resistive construction as specified in Section 4304 for all buildings more than eight (8) stories or eighty-five (85) feet in height.

The type of floor construction used shall provide means to keep the beams and girders from spreading, either by installing ties or bridging, with no laterally unsupported length of joists being permitted to exceed eight (8) feet. The floor and roof panel construction shall be so designed and constructed as to transfer horizontal forces to such parts of the structural frame as are designed to carry the horizontal forces to the foundations. All beams and girders in such floor construction shall be protected by not less than two-hour fire-resistive materials as specified in Chapter 43.

Where wood sleepers are used for laying wood floors the space between the floor slab and the underside of the wood flooring shall be filled with incombustible material in such a manner that there will be no open spaces under the flooring which will exceed one hundred (100) square feet in area and such space shall be filled solidly under all partitions so that there is no communication under the flooring between adjoining rooms.

**Sec. 1811.** Roofs shall be constructed of any materials or combination of materials as allowed for floors in Section 1810.

Roof Covering shall be a "Fire-Retardant" roofing as specified in Section 4305.

Any drainage fill placed on a roof deck of any building shall be an incombustible material and such fill shall be considered as a part of the dead load in designing the roof framing.

**Sec. 1812.** Stairs and stair platforms shall be constructed of reinforced concrete, iron or steel with treads and risers of concrete, iron or steel. Brick, marble, tile or other hard incombustible materials may be used for the finish of such treads and risers.

All stairs shall be designed and constructed as specified in Chapter 33 and as specified under Occupancy in Part III.

**Sec. 1813.** (a) Doors, windows and other openings in the exterior walls shall be protected by one-hour fire-resistive construction as specified in Section 4304.

Exceptions: (1) The provisions of this Section shall not apply to doors, windows and other openings which face directly upon, and are

## Floor Construction

## Roof Construction

## Stairs

## Doors and Windows

not within fifty (50) feet in Fire Zone No. 1 or are not within thirty (30) feet in Fire Zones No. 2, 3 and 4, of the opposite side of a public street or other public place, this distance to be measured at right angles to the plane of the wall in which such openings occur.

(2) The provisions of paragraph (a) of this Section shall not apply to openings in an outer court twenty (20) feet or more in width parallel to and facing upon a street on public place, provided such openings are not within twenty (20) feet of an adjacent property line.

**Projections  
from the  
Building**

**Sec. 1814.** Bays, oriels and similar projections shall be constructed of incombustible materials with walls, floors and roofs as specified in this Chapter and as specified in Chapter 35.

Porches and exterior balconies shall be constructed of incombustible materials but structural steel or iron members need not be fireproofed; provided, that loading platforms for warehouses, freight depots and similar buildings may be of heavy timber construction with wood floors not less than one and five-eighth ( $1\frac{5}{8}$ ) inches thick. Such wood construction shall not be carried through the exterior walls of any Type I building.

Cornices, marquises and similar appendages which are a part of a Type I building shall be constructed of substantial incombustible materials and as specified in Chapter 45.

**Penthouses  
and  
Skylights**

**Sec. 1815.** Penthouses and other roof structures shall be constructed of masonry or reinforced concrete, and all doors, windows and other openings therein shall be protected by one-hour fire-resistive construction or shall have one-hour fire-resistive windows as specified in Chapters 36 and 43.

Skylights shall be constructed of one-hour fire-resistive materials as specified in Chapter 43 and in Section 3402.

**Combustible  
Materials  
Regulated**

**Sec. 1816.** Wood or unprotected steel or iron shall be permitted in the following places:

(1) Mezzanine floors may be of wood or unprotected steel provided that there shall be not more than two such mezzanines in any room of any building and provided, further, that no such mezzanine floor or floors shall cover more than thirty-three and one-third ( $33\frac{1}{3}$ ) per cent of the area in the room where located. Such mezzanine floors constructed in Fire Zone No. 1 shall be of heavy timber construction as specified for floor construction in Type II buildings.

(2) Show window frames and aprons, also show cases and other appurtenances on the first floors of stores or other similar buildings may be of wood with or without unprotected steel or iron.

(3) Trim, picture molds, chair rails, wainscoting, baseboards, hand rails, show window backing, temporary partitions, floors, and sleepers may be of wood except that wood floors and sleepers are prohibited in basements or cellars. Wood doors may be used except in stair, elevator or

other shaft enclosures or where specifically prohibited under Occupancy in Part III.

(4) Roofs may be sheathed by wood planks of two and one-half ( $2\frac{1}{2}$ ) inch nominal thickness when such sheathing is more than thirty (30) feet distant from any floor, balcony or gallery and when such plank sheathing is protected on the underside by a ceiling of not less than one-hour fire-resistive construction as specified in Section 4301.

**CHAPTER 19 — TYPE II BUILDINGS**

**(Heavy Timber Construction)**

<b>Definition</b>	<p><b>Sec. 1901.</b> “Type II” or “Type II Buildings”. The structural frame shall be of structural steel or iron which shall be fireproofed, of reinforced concrete, of masonry or of heavy timbers, provided, that in buildings not exceeding one story and sixty-five (65) feet in height the structural steel or iron may have the fireproofing omitted. Foundations and exterior walls shall be of solid masonry or reinforced concrete. Inner court walls shall be of masonry or reinforced concrete of one-hour fire-resistive construction or of protected solid wood. Roof construction shall be of wood, or incombustible materials. Floors and non-bearing partitions shall be of wood or incombustible materials.</p>
<b>Height Allowable</b>	<p><b>Sec. 1902.</b> Type II buildings shall not exceed a height of seventy-five (75) feet in which height there shall be not more than seven (7) stories; provided, that the height of a building erected on sloping ground may be not to exceed seventy-five (75) feet plus a vertical distance equal to the vertical change in slope along the length of any side of such building but in no case shall such height exceed eighty-five (85) feet above the adjacent finished ground level; provided, further, that no one-story building shall exceed a height of sixty-five (65) feet.</p> <p>Towers, spires and steeples erected as a part of the building and not used for habitation or storage may extend not to exceed twenty (20) feet above such height limit.</p>
<b>Area Allowable</b>	<p><b>Sec. 1903.</b> The floor area of a Type II building shall be limited according to Occupancy as specified in Part III of this Code.</p>
<b>Foundations</b>	<p><b>Sec. 1904.</b> Foundation walls and footings shall be of solid masonry as specified in Chapter 29 or of reinforced concrete as specified in Chapters 26 and 29, and shall be proportioned as specified in Sections 2306 and 2802.</p>
<b>Exterior and Inner Court Walls</b>	<p><b>Sec. 1905.</b> All exterior walls, fire walls and fire division walls shall be of masonry or reinforced concrete as specified in Chapter 29 and shall be of not less than four-hour fire-resistive construction as specified in Section 4302.</p> <p>All walls within five (5) feet of adjacent property lines (excepting property lines abutting a street or an alley) and all walls within ten (10) feet of other buildings on the same property shall be provided with a parapet wall at least thirty (30) inches high above the roof at all points, provided that parapet walls need not be constructed on buildings twenty (20) feet or less in height or where the roof slopes more than twenty (20) degrees from the horizontal back from the exterior wall of such building.</p> <p>Inner court walls may be constructed the same as exterior walls or shall be of not less than four-inch solid wood laminated construction protected on the weather side thereof by materials of not less than one-hour fire-resistive construction as specified in Chapter 43.</p>

**Sec. 1906.** Interior partitions shall be of one-hour fire-resistive construction as specified in Section 4302 or may be of solid wood construction formed of two layers of one-inch nominal matched boards or of two-inch nominal tongued and grooved wood planking or of solid wood laminated construction not less than three and five-eighths ( $3\frac{5}{8}$ ) inches thick.

Where wood partitions abutt or adjoin masonry walls they shall be tied as specified in Section 2507.

Temporary partitions as specified in Section 1806 may be used.

**Sec. 1907.** Enclosures for elevator shafts, vent shafts, stair wells and other vertical openings shall be of two-hour fire-resistive construction as specified in Chapters 30 and 43; provided, that in buildings not more than three (3) stories in height which are completely sprinkled as specified in Chapter 38 such enclosure walls may be of any construction permitted for interior partitions.

A parapet wall or hand rail at least thirty (30) inches in height above the roof shall be provided around all open shaft enclosures extending through the roof.

**Sec. 1908.** The structural frame shall be of reinforced concrete, structural steel or iron or of solid wood.

All wood columns in such structural frame shall be directly superimposed, one above the other, (no girders or bolsters between columns) and shall be provided with steel or cast iron caps or pintles which shall be self-releasing wherever any horizontal members are framed into such columns. No wood column shall be less than eight (8) inches nominal in its least dimension and no beam, girder or joist shall be less than six (6) inches nominal in its least dimension nor less than forty-eight (48) square inches nominal in cross-sectional area. All wood framing shall be as specified in Chapter 25.

**Sec. 1909.** (a) All structural steel or iron members (not including frames and structural members for elevators and elevator enclosures) shall be thoroughly fireproofed. Such fireproofing shall be of three-hour fire-resistive protection for columns, and two-hour fire-resistive protection for beams, girders and floor systems, and all fireproofing shall be determined as specified in Chapter 43; provided, that such fireproofing may be omitted when the building does not exceed a height of one story and sixty-five (65) feet.

Exceptions: (1) The thickness of the fireproofing on the outer edge of lugs or brackets on columns may be reduced to not less than one (1) inch.

(2) The masonry over window openings may be supported by a steel plate, angle or similar member which is not fireproofed on the under side, provided the member is supported at proper intervals from a structural beam or girder which is fireproofed on all sides. For openings in masonry bearing walls not exceeding four (4) feet in width, an angle or similar member supported by masonry and not fireproofed on the under side may be used.

## **Partitions**

## **Enclosure of Vertical Openings**

## **Structural Framework**

## **Fireproofing of Structural Members**

(3) Where the structural steel framework of the roof of a Group A, B or C building is not less than twenty-five (25) feet above any floor or balcony, fireproofing of all members of the roof construction may be omitted.

(4) Where the structural steel framework of the roof of a Group A, B or C building is more than eighteen (18) feet and less than twenty-five (25) feet above any floor or balcony the roof construction shall be protected by a suspended ceiling of not less than two-hour fire-resistive construction as specified in Chapter 43, and such ceiling shall be not less than six (6) inches distant from any part of such roof construction.

(b) Wood structural members shall not be required to be fireproofed.

(c) All reinforced concrete columns shall be thoroughly fireproofed with not less than three-hour fire-resistive protection and all joists, beams, girders and slabs shall be thoroughly fireproofed with not less than two-hour fire-resistive protection outside of all steel reinforcing as specified in Section 4301.

**Floor  
Construction**

**Sec. 1910.** Floor construction shall be as specified for Type I buildings or shall be of one of the types noted below:

(1) Floor construction shall be of tongued and grooved or splined lumber not less than three (3) inches nominal in thickness with a top layer of flooring of one (1) inch nominal in thickness laid thereon.

(2) Construction of solid lumber placed on edge and securely spiked together to make a floor not less than four (4) inches nominal in thickness.

If such floor is six (6) inches nominal or more in thickness the lumber shall be air seasoned or kiln dried.

A space of one-half ( $\frac{1}{2}$ ) inch shall be required between all floor construction and the wall which it adjoins, to allow for swelling in case the floor becomes wet. This space shall be properly covered by a molding so arranged that it will not interfere with the swelling and shrinking movements of the flooring.

Wood joists, beams and girders supported by masonry walls shall be anchored thereto as specified in Section 2506.

The timbers and planking shall be self-releasing at end support on walls and no planking or timber shall extend through or across any fire, party or division walls.

**Roof  
Construction**

**Sec. 1911.** Roof construction shall be as specified for floor construction in Section 1910 except that the minimum allowable thickness shall be two and one-half ( $2\frac{1}{2}$ ) inches nominal, the timbers and planking shall be self-releasing at end support on walls and no planking or timber shall extend across or through fire, party or division walls. Wood joists, beams, girders and rafters supported by masonry walls shall be anchored thereto as provided in Section 2508.

Roof covering shall be a "Fire-Retardant" roofing as specified in Section 4305 and shall be required over all combustible roof construction.

**Sec. 1912.** Stair construction may be of wood in buildings not exceeding three (3) stories in height.

In buildings four (4) or more stories in height all stairs and stair construction shall be as required for Type I buildings.

All stairs and exits shall be designed and constructed as specified in Chapter 33 and as specified under Occupancy in Part III.

**Sec. 1913.** (a) Doors, windows and other openings in the exterior walls shall be protected by one-hour fire-resistive construction as specified in Section 4304.

Exceptions: (1) The provisions of this Section shall not apply to doors, windows and other openings which face directly upon, and are not within fifty (50) feet in Fire Zone No. 1 or are not within thirty (30) feet in Fire Zones No. 2, 3 and 4, of the opposite side of a public street or other public place, this distance to be measured at right angles to the plane of the wall in which such openings occur.

(2) The provisions of paragraph (a) shall not apply to openings in an outer court twenty (20) feet or more in width parallel to and facing upon a street or public place, provided such openings are not within twenty (20) feet of an adjacent property line.

**Sec. 1914.** Bays, oriels and similar projections shall be constructed of incombustible materials with walls, floors and roof as specified in this Chapter and in Chapter 35.

Porches and exterior balconies shall be constructed of incombustible materials but structural steel or iron members need not be fireproofed; provided, that loading platforms for warehouses, freight depots and other similar buildings may be of heavy timber construction with wood floors not less than one and five-eighths ( $1\frac{5}{8}$ ) inches thick. Such wood construction shall not be carried through the exterior walls of any Type II building.

Cornices, maquises and similar appendages which are a part of a Type II building shall be constructed of substantial incombustible materials and as specified in Chapter 45.

**Sec. 1915.** Penthouses shall be as required for Type I construction or shall be constructed with two-hour fire-resistive construction as specified in Chapters 36 and 43.

Skylights shall be of one-hour fire-resistive construction as specified in Chapters 34 and 43.

**Sec. 1916.** No wood lath or wood furring shall be allowed in any building of Type II Construction, but unprotected steel or iron or wood will be allowed in the following places:

(1) Mezzanine floors may be of wood or unprotected steel, provided that there shall be not more than two such mezzanines in any room of any building, and provided, further, that no such mezzanine floor or floors shall cover more than thirty-three and one-third ( $33\frac{1}{3}$ ) per cent of the area in the room where located.

**Stair  
Construction**

**Doors and  
Windows**

**Projections  
from the  
Building**

**Penthouses  
and  
Skylights**

**Combustible  
Materials  
Regulated**



## **Sec. 1916**

(2) Show window frames and aprons, also show cases and other appurtenances on the first floors of stores and other similar buildings may be of wood, with or without unprotected steel or iron, provided that the exterior of such window frames and aprons are protected by incombustible materials.

(3) Trim, hand rails, show window backing and temporary partitions as specified in Section 1906, picture molds, chair rails and wainscotting or baseboards may be of wood. Wood doors may be used, except in stair, elevator and other shaft enclosures, or where specifically prohibited under Occupancy in Part III.

**CHAPTER 20 — TYPE III BUILDINGS****(Ordinary Masonry)**

**Sec. 2001.** "Type III" or "Type III Buildings." The interior load bearing construction may be masonry or reinforced concrete walls or a structural frame of steel, reinforced concrete or wood. Foundations and exterior walls shall be of masonry or reinforced concrete. Partitions, floors and roof framing may be of wood.

**Definition**

**Sec. 2002.** Type III buildings shall not exceed a height of fifty-five (55) feet in which height there shall be no more than five (5) stories; provided, that the height of a building erected on sloping ground may be fifty-five (55) feet plus a vertical distance equal to the vertical change in slope along and in the length of any side of such building but in no case shall such height exceed sixty-five (65) feet above the adjacent finished ground level; and provided, further, that towers, spires and steeples erected as a part of such building and not used for habitation or storage may extend not to exceed fifteen (15) feet above such height limit.

**Height Allowable**

**Sec. 2003.** The floor area of Type III buildings shall be limited according to Occupancy as specified in Part III.

**Area Allowable**

**Sec. 2004.** Foundation walls and footings shall be of solid masonry as specified in Chapter 29 or of reinforced concrete as specified in Chapters 26 and 29, and shall be proportioned as specified in Sections 2306 and 2802.

**Foundations**

**Sec. 2005.** All exterior walls, fire walls and fire division walls shall be of masonry or reinforced concrete as specified in Chapter 29 and shall be of not less than four-hour fire-resistive construction as specified in Section 4302.

**Exterior and Inner Court**

Inner court walls and all other walls not forming the exterior walls of the building may be constructed as required for Type I or Type II buildings, or shall be constructed of wood protected on the weather side by not less than one-hour fire-resistive construction as specified in Chapter 43.

All walls within five (5) feet of adjacent property lines (except property lines abutting a street or alley) and all walls within ten (10) feet of other buildings on the same property shall be provided with parapet walls at least thirty (30) inches high above the roof at all points; provided, that parapet walls need not be constructed on buildings twenty (20) feet or less in height or where the roof slopes more than twenty (20) degrees from the horizontal back from the exterior wall of such building.

**Sec. 2006.** Partitions of wood shall be constructed as required in Chapter 25. In buildings of four (4) stories or more in height all partitions shall be of one-hour fire-resistive construction as specified in Section 4302. Bearing partitions, when constructed of wood, shall not support more than two (2) stories and a roof.

**Partitions**

Exceptions: Partitions dividing portions of stores, offices or similar places occupied by one tenant only may be constructed of wood panels or similar light construction up to three-fourths ( $\frac{3}{4}$ ) of the height of the

room in which placed; when more than three-fourths ( $\frac{3}{4}$ ) the height of the room, such partitions shall have not less than the upper one-fourth ( $\frac{1}{4}$ ) of the partition constructed of glass set in sash.

**Enclosure  
of Vertical  
Openings**

**Sec. 2007.** Enclosures for elevator shafts, vent shafts, stair wells and other vertical openings when required because of Occupancy in Part III shall be of one-hour fire-resistive construction as specified in Chapters 30 and 43.

A parapet wall or hand rail at least thirty (30) inches in height above the roof shall be provided around all open shaft enclosures extending through the roof.

**Structural  
Framework**

**Sec. 2008.** Structural framework shall be of steel, iron, reinforced concrete, masonry or wood and shall be designed and erected as specified in Chapter 26 for reinforced concrete, Chapter 27 for steel and iron, Chapters 22 and 25 for wood and Chapters 24 and 29 for masonry.

**Fire-  
proofing  
Struc-  
Members**

**Sec. 2009.** Fireproofing of steel, iron or wood structural members may be omitted unless otherwise provided because of Location as in Part IV or Occupancy as in Part III, or as specified in Section 2010.

**Floor  
Construction**

**Sec. 2010.** Floors may be constructed of reinforced concrete as specified in Chapter 26, of masonry as specified in Chapter 24, of wood as specified in Chapter 25, or of steel or iron as specified in Chapter 27.

In buildings of four (4) stories or more in height the lower side of all metal or wood floor or roof construction shall be entirely protected by a ceiling of one-hour fire-resistive construction as specified in Chapter 43.

In all buildings having a cellar or basement, except dwellings, the under side of the first floor construction when of metal or wood shall be protected by a ceiling of one-hour fire-resistive construction as specified in Chapter 43.

Wood joists, beams and/or girders supported by masonry walls shall be anchored thereto as specified in Section 2506.

**Roof  
Construction**

**Sec. 2011.** Roof construction shall be of any Type of Construction permitted for floors except in buildings four (4) stories or more in height as specified in Section 2010 and except where otherwise required because of Occupancy in Part III.

Wood rafters, joists, purlins, beams and girders supported by masonry walls shall be anchored thereto as specified in Section 2508.

Attic or roof spaces shall be divided into areas not exceeding twenty-five hundred (2500) square feet as specified in Section 2510.

Roof covering shall be a "Fire-Retardant" roofing as specified in Section 4305.

**Stair  
Construction**

**Sec. 2012.** Stairs may be of steel, iron, reinforced concrete, masonry or wood and shall be designed and constructed as specified in Chapter 33, and as specified under Occupancy in Part III.

**Sec. 2013.** Doors, windows and other openings in exterior walls may be of wood or of plain glass and wood sash unless otherwise specified under Occupancy in Part III or Location in Part IV.

**Doors and  
Windows**

**Sec. 2014.** Bays, oriels and similar projections shall be constructed of incombustible materials with walls, floors and roof as specified in this Chapter and in Chapter 35.

**Projections  
from the  
Building**

Porches and exterior balconies shall be constructed of incombustible materials but structural steel or iron members need not be fireproofed; provided that loading platforms for warehouses, freight depots and similar buildings may be of heavy timber construction with wood floors not less than one and five-eighths ( $1\frac{5}{8}$ ) inches thick. Such wood construction shall not be carried through the exterior walls of any Type III building.

Cornices, marquises and similar appendages which are a part of a Type III building shall be constructed of substantial incombustible materials and as specified in Chapter 45.

**Sec. 2015.** Penthouses and other roof structures shall be of not less than one-hour fire-resistive construction as specified in Chapters 36 and 43.

**Penthouses  
and  
Skylights**

Skylights shall be of not less than one-hour fire-resistive construction as specified in Chapter 34.

**Sec. 2016.** Wood shall be permitted in a building of Type III Construction except where specifically prohibited as specified under Occupancy in Part III or Location in Part IV.

**Combustible  
Materials  
Regulated**

No enclosed air space in any vertical wood framing shall have a dimension greater than seven (7) feet.

Combustible insulating materials may be placed in the partition, floor or roof framing but shall in no way interfere with the fire blocking or fire separations required by this Code.

**CHAPTER 21 — TYPE IV BUILDINGS**

**(Metal Frame)**

<b>Definition</b>	<b>Sec. 2101.</b> “Type IV” or “Type IV Buildings.” The structural framework shall be of steel, iron, masonry or reinforced concrete and the exterior walls and roof shall be of metal or other incombustible materials. Foundations shall be of masonry or reinforced concrete. Partitions and floor construction shall be as specified in this Chapter.
<b>Height Allowable</b>	<b>Sec. 2102.</b> Type IV buildings shall not exceed a height of forty-five (45) feet in which height there shall be not more than one (1) story and a mezzanine floor; provided that the height of such building erected on sloping ground may be forty-five (45) feet plus a vertical distance equal to the vertical change in slope along and in the length of any side of such building, but in no case shall such height exceed fifty-five (55) feet above the adjacent finished ground level; provided, further, that towers, spires and steeples erected as a part of such building and not used for habitation or storage may extend not to exceed ten (10) feet above such height limit.
<b>Area Allowable</b>	<b>Sec. 2103.</b> The floor area of a Type IV building shall be limited as specified under Occupancy in Part III and Location in Part IV.
<b>Foundations</b>	<b>Sec. 2104.</b> Foundation walls and footings shall be of solid masonry as specified in Chapter 29 or of reinforced concrete as specified in Chapters 26 and 29, and shall be proportioned as specified in Sections 2306 and 2802.
<b>Exterior Walls</b>	<b>Sec. 2105.</b> Exterior walls shall be of galvanized iron or other non-corrodible metal of not less than twenty-six (26) gauge or shall be of incombustible materials.
<b>Partitions</b>	<b>Sec. 2106.</b> Interior partitions shall be of metal or other incombustible materials.
<b>Enclosure of Vertical Openings</b>	<b>Sec. 2107.</b> No restrictions.
<b>Structural Framework</b>	<b>Sec. 2108.</b> The structural framework shall be of steel or iron as specified in Chapter 27, or masonry as specified in Chapters 24 and 29 or of reinforced concrete as specified in Chapter 26.
<b>Fireproofing Structural Members</b>	<b>Sec. 2109.</b> Fireproofing of structural members shall not be required.
<b>Floor Construction</b>	<b>Sec. 2110.</b> The floors shall be of any type of construction permitted in Type III buildings or may be of wood blocks or of any incombustible material.
<b>Roof Construction</b>	<b>Sec. 2111.</b> Roof construction shall be entirely of metal or other incombustible materials provided that wood purlins not less than four (4) inches nominal in least dimension may be used to support metal roof covering.

Roof covering shall be of a non-corrodible metal or may be a "Fire-Retardant" roofing as specified in Section 4305.

**Sec. 2112.** Stairs shall be of steel, iron, reinforced concrete, masonry or wood and shall comply with the requirements of Chapter 33.

**Sec. 2113.** Openings in exterior walls shall be protected by doors, windows or shutters of metal or of metal frame, metal sash and wire glass; provided that such protection may be omitted when such openings are sixteen (16) feet or more from the opposite side of any street, alley or public place, from an adjoining building or from adjacent property lines.

**Sec. 2114.** Porches, cornices, skylights, marquees, canopies and all other similar projections from the building shall be of metal or incombustible materials, except that a loading platform may be constructed of wood.

**Sec. 2115.** Penthouses and other roof structures shall be constructed entirely of incombustible materials except that roofs of such structures may be constructed as specified in Section 2111.

Skylights shall be of one-hour fire-resistive construction as specified in Chapters 34 and 43.

**Sec. 2116.** The inner side of walls and under side of roof shall not be ceiled with wood or wood lath and plaster but may be ceiled with any incombustible material.

**Stair  
Construction**

**Doors and  
Windows**

**Projections  
from the  
Building**

**Penthouses  
and  
Skylights**

**Combustible  
Materials  
Regulated**

## **CHAPTER 22 — TYPE V BUILDINGS**

### **(Wood Frame)**

<b>Definition</b>	<b>Sec. 2201.</b> “Type V” or “Type V Buildings”. Enclosing walls, interior walls, partitions, floors and roofs shall be of wood or of wood in combination with other materials except where prohibited as specified under Occupancy in Part III. Any buildings which cannot be classed as a Type I, II, III, or IV building shall be considered to be of Type V.
<b>Height Allowable</b>	<b>Sec. 2202.</b> Type V buildings shall not exceed a height of thirty-five (35) feet in which height there shall be no more than three (3) stories; provided that the height of a building erected on sloping ground may be thirty-five (35) feet plus a vertical distance equal to the vertical change in slope along and in the length of any side of such building but in no case shall such height exceed forty-five (45) feet above the adjacent finished ground level; provided, further, that spires, towers or steeples erected as a part of such building and not used for habitation or storage may extend not to exceed ten (10) feet above such height limit.
<b>Area Allowable</b>	<b>Sec. 2203.</b> The maximum floor area allowable for a Type V building shall in no case exceed that specified under Occupancy in Part III or Location in Part IV.
<b>Foundations</b>	<p><b>Sec. 2204.</b> All exterior walls of Type V buildings shall be supported on continuous masonry or reinforced concrete walls or footings and shall be of sufficient size to safely support the loads imposed as determined from the character of the soil.</p> <p>Exceptions: (1) For Type V buildings (except residence buildings) of post and girder construction continuous walls or footings shall not be required.</p> <p>(2) A one (1) story building, except a dwelling, which does not exceed four hundred (400) square feet in area, may be constructed without masonry or reinforced concrete foundation, providing such building is placed on an all-heart redwood, cedar or cypress, or on a creosoted wood mudsill.</p> <p>Foundations for all buildings where the surface of the ground slopes more than one (1) foot in ten (10) feet shall be level or shall be stepped so that both top and bottom of such foundation shall be level.</p> <p>Foundation walls used as retaining walls and all retaining walls shall be not less than eight (8) inches in thickness when five (5) feet or less in height. Such walls when more than five (5) feet in height shall be not less than eight (8) inches in thickness at the top and shall be increased one (1) inch in thickness for every additional foot in height.</p> <p>Foundations of Type V buildings may be of piles, constructed as provided in Chapter 28.</p> <p>Screened openings through foundation walls or exterior partitions shall be provided for cross ventilation under the first floor on the basis of two (2) square feet for each twenty-five lineal feet or major fraction thereof of exterior wall, except that such openings need not be placed in the front of such building. (See Appendix).</p>

**Exterior  
Walls and  
Wall  
Coverings**

**Sec. 2205.** Exterior walls of all Type V buildings having a floor area of four hundred (400) square feet or more shall be constructed with studding not less than two inches by four inches (2" × 4") spaced not more than sixteen (16) inches on centers, or such walls may be constructed of not less than four inch by four inch (4" × 4") posts spaced not more than five (5) feet on centers or of larger members designed as specified in Chapter 25, or may be of post and beam framing with plank sheathing not less than one-and one-half (1½) inches thick or may be of laminated construction not less than four (4) inches nominal in thickness with the structural assembly properly designed to support all loads.

Buildings three stories in height shall have the first story studs not less than two inches by six inches (2" × 6") spaced not more than sixteen (16) inches on centers.

Where studs continue through more than one story, joists shall be nailed securely to the studs and shall be supported upon a one inch by three inch (1" × 3") ribbon notched into the studs and securely nailed thereto. Where stories are framed separately, each tier of studding shall have top and bottom plates and the top plates shall be doubled and lapped at all corners and intersections. Laps in separate pieces of the top plate shall be staggered two (2) feet.

All exterior walls and partitions shall be thoroughly and effectively angle braced.

Maximum allowable height of two inch by four inch (2" × 4") stud framing shall be fourteen (14) feet and for two inch by six inch (2" × 6") stud framing shall be twenty (20) feet unless the wall is supported laterally by adequate framing in a horizontal direction, perpendicular to the direction of the stud wall.

All walls shall be effectively fire stopped at the floor and ceiling and at the spring of cove in a coved ceiling. Fire stops shall also be placed between the floor and the ceiling in such a manner that there shall be no concealed air spaces with a dimension greater than seven (7) feet. Fire stopping shall consist of not less than two (2) inch material and shall be the full thickness of the stud wall. Where stories are not framed separately, fire stopping shall be placed behind the ribbon at the ceiling line and at the top of joist at the floor line. Such fire stopping shall be two (2) inches thick and the full width of the stud.

All openings four (4) feet wide or less shall be provided with double headers not less than two (2) inches thick placed on edge, and such headers shall have two (2) inch solid bearing to the floor or bottom plate. All openings more than four (4) feet wide shall be trussed or provided with lintels which shall have not less than two (2) inch solid bearing to the floor or bottom plate.

Underpinning shall be not less in size than the studding of the story above; provided, that all underpinning exceeding four (4) feet in height shall be not less in size than the studding required for an additional story. All such underpinning shall be effectively braced.



The space under the first floor joists of all Type V buildings (except such space as is occupied by a basement or cellar) shall be provided with a sufficient number of ventilating openings to insure ample ventilation and such openings shall be covered with wire mesh with openings in such mesh not greater than one-half ( $\frac{1}{2}$ ) inch in any dimension. Such ventilating openings shall be proportioned on the basis of two (2) square feet for each twenty-five (25) lineal feet or major fraction thereof of exterior wall; except, that such openings need not be placed in the front of such building.

An all-heart redwood, cedar or cypress, or a creosoted wood mudsill not less than two (2) inches thick and not less in width than the wall framing supported thereon shall be placed under all walls or partitions that rest on masonry or reinforced concrete foundations.

All Type V buildings three (3) stories in height, when the walls of such buildings are shingled, shall have the exterior walls thoroughly covered with a solid sheathing of wood not less than five-eighths ( $\frac{5}{8}$ ) of an inch thick, or approved fiber-board not less than seven-sixteenths ( $\frac{7}{16}$ ) of an inch thick of approved incombustible sheathing not less than one-half ( $\frac{1}{2}$ ) an inch thick.

All exterior walls shall be covered on the outside with weatherboarding, shingles, stucco, masonry veneer or galvanized metal as specified in this section or by other similar approved materials.

The minimum requirements for wall coverings for Type V buildings are as specified in parts (a), (b), (c), (d), and (e) of this Section.

(a) Weatherboarding. Studs shall be covered on the outside face with one layer of two-ply waterproofed building paper applied and tacked shingle fashion with joints horizontal. Horizontal joints of the paper shall be lapped at least two (2) inches and perpendicular joints at least six (6) inches. Weatherboarding, when in place, shall have an average thickness of not less than five-eighths ( $\frac{5}{8}$ ) of an inch and a minimum thickness of not less than three-eighths ( $\frac{3}{8}$ ) of an inch. Such weatherboarding shall be placed over the paper and shall be securely nailed to the studding with not less than two nails to each stud in each piece of such weatherboarding. Horizontal joints in the weatherboarding shall be tongued and grooved or ship-lapped joints, or such weatherboarding shall be laid shingle fashion and lapped not less than one-half ( $\frac{1}{2}$ ) inch. Building paper may be omitted where the interior face of the studs is not covered or where there is no human occupancy. Weatherboarding of lesser thickness may be used provided the outside face of the studs is first sheathed solid with boards not less than five-eighths ( $\frac{5}{8}$ ) of an inch thick.

(b) Shingles or Shakes. Shingles or shakes may be used for the exterior wall covering when applied as follows: The outside face of the studs shall be first sheathed with board of uniform thickness not less than twenty-five thirty-seconds ( $\frac{25}{32}$ ) of an inch thick and such sheathing shall be securely nailed to the studding with not less than two (2) eight penny (8) common nails to each stud in each piece of sheathing eight (8) inches or less in width and not less than three (3) such nails when such sheathing boards exceed

eight (8) inches in width. Shingles or shakes shall be applied over such sheathing as specified for roofs in Section 4305.

(c) Stucco. Stucco may be applied with or without sheathing or similar backing.

In all cases except back plastered construction a substantial waterproofed paper or asphalt saturated felt weighing not less than fourteen (14) pounds per one hundred (100) square feet or any substantial waterproofed paper which successfully passes a sixty (60) pound Mullen test shall be applied weatherboard fashion directly over the studs or sheathing. Horizontal joints shall be lapped not less than two (2) inches and vertical joints not less than six (6) inches. Where sheathing or similar backing is not used a sixteen (16) W. & M. gauge wire stretched taut horizontally across the stud frame at not more than eight (8) inch centers shall be securely fastened in place before the paper or felt is applied; provided, that where such paper or felt is fastened to the metal reinforcing in such a manner as not to affect the waterproof qualities of such paper or felt the wire need not be installed.

In all cases a metal reinforcement shall be used of either expanded metal or wire fabric as follows:

1. Expanded metal cut from sheets not less than twenty (20) U.S. gauge in thickness with mesh not less than three-fourths ( $\frac{3}{4}$ ) inch in least dimension, nor more than four (4) inches in greatest dimension and not exceeding six (6) square inches in area; the fabric shall weigh not less than one and eight-tenths (1.8) pounds per square yard.

2. Wire fabric composed of wires not smaller than shown in the following table and with no openings or mesh therein less than three-fourths ( $\frac{3}{4}$ ) inch nor greater than two (2) inches. The minimum allowable gauge of the wire for the various meshes shall be as follows:

For openings not exceeding 1 inch — 18 W. & M. Gauge.

For openings not exceeding 1  $\frac{1}{2}$  inches — 16 W. & M. Gauge.

For openings not exceeding 2 inches — 14 W. & M. Gauge.

3. Expanded metal lath weighing not less than three (3) pounds per square yard.

4. Electrically welded wire of sixteen (16) W. & M. gauge with openings not exceeding two (2) inches in greatest dimension and not exceeding four (4) square inches in area.

Metal reinforcing shall be securely fixed in place using a furring device that will positively fur the metal reinforcing at least one-fourth ( $\frac{1}{4}$ ) inch from the studs, sheathing or other backing. No form of strips or metal rods shall be used for furring which will serve to weaken the stucco if used. Metal reinforcing shall be secured with not less than four penny (4d) nails driven to at least three-fourths ( $\frac{3}{4}$ ) inch penetration in the studs or sheathing. Nails and furring devices shall be not more than six (6) inches apart vertically. Horizontal and vertical joints of the metal reinforcing shall be lapped at least one full mesh. All horizontal joints between studding shall have not less than one tie with number eighteen (No. 18) annealed tie wire except when building is sheathed and all vertical joints shall be made at the studs when attached directly thereto.

Stucco shall consist of three (3) coats: (1) First or scratch coat, (2) Second or brown coat, (3) Finish coat. The total thickness of the three coats shall be not less than seven-eighths ( $7/8$ ) of an inch thick at every point and on every three story building the total thickness shall be not less than one and one-fourth ( $1\frac{1}{4}$ ) inches. No one coat of stucco shall be less than one-fourth ( $1/4$ ) inch thick, except the finish coat, which shall be not less than one-eighth ( $1/8$ ) inch in thickness at any point.

The stucco shall be of Portland cement and sand as specified in Chapter 26, with an addition of not more than ten (10) per cent of hydrated lime or similar material based on volume of cement in either the scratch coat or brown coat and with not more than thirty-three and one-third ( $33\frac{1}{3}$ ) per cent of hydrated lime or similar material based on volume of cement in the finish coat.

The first or scratch coat of stucco shall be shoved thoroughly through the metal reinforcing until all space between the metal and the backing is filled solidly and such coat shall be kept thoroughly moist during the first twenty-four (24) hours after being applied. At least seven (7) days shall elapse between the application of the scratch coat and the application of the brown coat.

The above requirements shall not apply to stucco placed on masonry backing. Before applying stucco on any masonry backing such backing shall be thoroughly washed and cleaned.

Gunitite, as defined in Chapter 26, shall be applied in not less than two (2) coats, and shall be reinforced as specified for "Stucco" in this Section. Gunitite shall be not less than three-fourths ( $3/4$ ) of an inch in thickness on one or two story buildings and not less than one (1) inch in thickness on three story buildings.

(d) Masonry Veneer. In all cases before applying masonry veneer a substantial waterproofed paper or asphalt saturated felt weighing not less than fourteen (14) pounds per one hundred (100) square feet shall be applied weatherboard fashion directly over the studs, sheathing or backing as specified for "Stucco" under part (c) of this Section, except that no wire need be stretched back of such paper.

Masonry veneer shall be not less than two and one-half ( $2\frac{1}{2}$ ) inches thick for one story only, and not less than four (4) inches thick for more than one story. The masonry shall be bonded to the studs by means of corrugated galvanized iron twenty-four (24) gauge strips or twenty penny (20d) nails, in both cases not more than sixteen (16) inches apart horizontally and twelve (12) inches apart vertically. Such veneer shall not be permitted above two stories, except for gables. The veneer shall be supported directly on the foundation.

(e) Galvanized Iron. Galvanized iron not less than twenty-eight (28) gauge may be used on stud walls without sheathing. Walls shall be effectively braced and nailing strips shall be placed in such manner as to permit the metal to be nailed at vertical intervals of not more than four (4) feet.

**Interior  
Partitions**

**Sec. 2206.** All interior partitions shall be constructed, framed and fire stopped as required for exterior walls as specified in Section 2205, except

that interior non-bearing partitions may have a single top plate, and except that where non-bearing partitions are approximately parallel and not more than four (4) feet apart, two inch by three inch (2" × 3") studs sixteen (16) inches on centers, may be used.

**Sec. 2207.** Girders supporting first floor joists in residence buildings shall be not less than four inches by four inches (4" × 4") for spans of five (5) feet or less, or not less than four inches by six inches (4" × 6") (placed on edge) for spans not more than seven (7) feet.

The following table gives the maximum allowable spans for floor joists of Douglas fir (Oregon pine) common grade, based on a forty (40) pound per square foot load uniformly distributed live load.

### Floor Construction

Size of Joists (Inches)	Spacing of Joists, Center to Center (Inches)	Maximum Allowable Span (Feet and Inches)	
		Plastered Ceiling Below	Without Plastered Ceiling Below
2 × 6	12	10- 0	12- 0
	16	9- 1	10- 6
	24	8- 0	8- 7
2 × 8	12	13- 3	15-11
	16	12- 1	13-11
	24	10- 8	11- 5
2 × 10	12	16- 8	19-11
	16	15- 3	17- 4
	24	13- 5	14- 5
2 × 12	12	20- 1	23-11
	16	18- 5	20-11
	24	16- 2	17- 5
2 × 14	12	23- 5	27- 8
	16	21- 5	24- 4
	24	18-11	20- 3
3 × 6	12	11- 8	15- 0
	16	10- 8	13- 1
	24	9- 4	10-10
3 × 8	12	15- 4	19- 8
	16	14- 0	17- 4
	24	12- 4	14- 4
3 × 10	12	19- 3	24- 7
	16	17- 8	21- 8
	24	15- 7	18- 0
3 × 12	12	23- 1	29- 4
	16	21- 3	25-11
	24	18- 9	21- 8
3 × 14	12	26-11	30- 0
	16	24-10	30- 0
	24	22- 1	25- 2

Joists of other grades, other woods and other sizes may be used, in which

case they shall not be stressed to exceed the maximum allowable fiber stress as specified in Chapter 25.

Floor joists shall have a clearance of not less than twelve (12) inches between the bottom of the joists and the surface of the ground underneath. (See Appendix—Section 2511.)

Joists under bearing partitions shall be installed as specified in Section 2506-(j). All joists, beams and girders shall be framing away at least two (2) inches from all flues and chimneys and at least four (4) inches from the back of any fireplace. All wood floor joists having a span of more than eight (8) feet shall have bridging as specified in Section 2506-(k).

Solid blocking not less than two (2) inches in thickness and the full depth of the joists shall be provided in the following places: over all girders except when not ceiled on the underside of joists, bearing walls, bearing partitions and around all stairways or other vertical openings. Such solid blocking shall serve as the required bridging specified in Section 2506-(k).

Trimmers and header joists more than four (4) feet long shall be doubled. Header joists over six (6) feet long and tail joists over twelve (12) feet long shall be hung in stirrups or metal joist hangers. Header beams shall be placed not closer than eighteen (18) inches from the face of a chimney. All spaces between chimneys and wood joists or beams shall be filled with loose incombustible materials or a metal collar connected to the chimney and fastened to the joists, beams or flooring to form an effective fire stop.

All joists shall have a minimum bearing of two (2) inches except when supported on a ribbon board and nailed securely to the adjoining stud.

Cutting of wood girders, beams or joists shall be limited to that permitted in Section 2506-(m).

**Roof and  
Ceiling  
Construction**

**Sec. 2208.** The following table gives the maximum allowable span for Douglas fir (Oregon pine) common grade, ceiling joists and roof rafters.

Size of Joists (Inches)	Spacing of Joists, Center to Center (Inches)	Maximum Allowable Span (Feet and Inches)	
		For Ceiling Joists	For Roof Rafters
2 × 4	12	11- 0	10- 4
	16	10- 0	9- 0
	24	8-11	7- 5
	32	7-10	6- 0
2 × 6	12	16- 7	15- 8
	16	15- 4	13- 9
	24	13- 8	11- 5
	32	12- 0	10- 0
2 × 8	12	21- 8	20- 8
	16	20- 2	18- 2
	24	18- 0	15- 1
	32	15-10	12- 0
2 × 10	12	26-10	25- 9
	16	25- 0	22- 9
	24	22- 6	18-10
	32	19- 6	14- 6

Joists or rafters of other grades, other woods and other sizes may be used, in which case they shall not be stressed to exceed the maximum allowable fiber stress as specified in Chapter 25.

The allowable span of roof rafters shall be measured from plate to ridge, except that where rafters are braced to ceiling joists and a complete truss is formed, to the satisfaction of the Building Inspector, the span shall be considered as the distance between intersecting points of trussing, when the allowable stresses are not exceeded.

Roof framing and trussing shall be thoroughly and effectively angle braced. Roof joists when supported on a ribbon board shall be well nailed to the stud.

Roof spaces shall be subdivided by a tightly fitted partition of matched wood or approved incombustible materials extending from the ceiling to the roof sheathing, so located as to subdivide this space into areas not exceeding twenty-five hundred (2500) square feet. All openings in such partitions shall have self-closing doors or equally effective devices to provide effective resistance to the passage of flames and gases.

**Sec. 2209.** Roof covering shall be a "Fire Retardant" roofing, except that for Groups H, I and J buildings an ordinary roofing may be used as specified in Section 4305. Wherever a composition roofing is used, the roof construction shall be solidly sheathed.

**Roof  
Covering**

**Sec. 2210.** Enclosure walls for elevator shafts, vent shafts, stair wells and similar vertical openings through a building shall be of not less than one-hour fire-resistive construction as specified in Chapters 30 and 43 and where required under Occupancy in Part III, except that chutes and dumb-waiter shafts with a cross sectional area of not more than four (4) square feet may be lined with not less than one-fourth ( $\frac{1}{4}$ ) inch asbestos covered with not less than twenty-four (24) gauge sheet metal with all joints in such sheet metal lock-lapped. All openings into any such vertical enclosures shall be protected by metal or metal-clad doors with either metal or metal-clad jambs, casings or frames.

**Enclosure  
of Vertical  
Openings**

**Sec. 2211.** Other parts of Type V Buildings may be constructed of wood or shall be constructed of approved combustible or incombustible materials, and all such wood construction shall be as specified in Chapter 25. The carrying capacity of all members shall be calculated by the accepted principles of mechanics. The actual dimensions of timbers shall be used and not the nominal sizes in computations for stress and determination of size.

**General**

Combustible insulating materials may be placed in partitions, floor or roof framing but shall in no way interfere with the fire blocking or fire separations required by this Code.

**PART VI.**  
**ENGINEERING REGULATIONS, QUALITY**  
**AND DESIGN OF THE MATERIALS**  
**OF CONSTRUCTION**  
**CHAPTER 23 — LIVE AND DEAD LOADS**

**Definitions**

**Sec. 2301.** Dead Load. The dead load of a building shall include the weight of the walls, permanent partitions, framing, floors, roofs and all other permanent stationary construction entering into and becoming a part of a building. (See Appendix for weights of construction materials.)

Live Load. The live load includes all loads except dead loads.

**General**

**Sec. 2302.** (a) Loads. Buildings and all parts thereof shall be of sufficient strength to support the estimated or actual imposed dead and live loads in addition to their own proper dead load, without exceeding the stresses noted elsewhere in this Code provided that no building or part thereof shall be designed for live loads less than those specified in the following sections. Impact shall be considered in the design of any structure where impact loads occur. (See Appendix for impact considerations.)

(b) Design. Any system or method of construction to be used shall admit of a rational analysis in accordance with well established principles of mechanics.

**Special  
Load Con-  
siderations**

**Sec. 2303.** (a) Provision shall be made in designing office floors for load of two thousand (2000) pounds placed upon any space two and one-half (2 1/2) feet square wherever this load upon an otherwise unloaded floor would produce stresses greater than those caused by a uniformly distributed load of fifty (50) pounds per square foot.

(b) Corridors in dwellings shall be designed for not less than forty (40) pounds per square foot.

(c) In designing floors to be used for industrial or commercial purposes the actual live load caused by the use to which the building or part of the building is to be put, shall be used in the design of such building or part thereof, and special provision shall be made for machine or apparatus loads when such machine or apparatus would cause a greater load than specified for such use in Section 2304.

(d) Floors in office buildings and in other buildings subject to shifting of partitions without reference to arrangement of floor beams or girders shall be designed to support in addition to other loads a single partition of the type used in the building placed in any position.

(e) Public garages and commercial or industrial buildings in which loaded trucks are placed, used or stored shall have the floor systems designed to support a concentrated rear wheel load of a loaded truck placed in any possible position.

**Sec. 2304.** The following unit loads shall be taken as the minimum live loads in pounds per square foot to be used in the design of buildings for the occupancies listed, and loads at least equal shall be assumed for uses not listed in this Section but which create or accommodate similar loadings.

**Unit Live  
Loads**

Apartments	40
Armories	150
Auditoriums—Fixed Seats	50
Movable Seats	100
Balconies and Galleries—Fixed Seats	50
Movable Seats	100
Dance Halls	100
Drill Rooms	100
Dwellings	40
Exterior Balconies	100
Fire Escapes	100
Garages	100
Gymnasiums	100
Hospitals—Wards and Rooms	40
Corridors and Public Rooms	100
Hotels—Guest Rooms and Corridors	40
Public Rooms	100
Corridors (Public)	100
Libraries—Reading Rooms	60
Corridors	100
Stack Rooms	125
Loft Building	100
Manufacturing—Light	75
Heavy	125
Marquise	60
Offices	50
Printing Plants—Press Rooms	150
Composing and Linotype Rooms	100
Public Rooms	100
Rest Rooms	50
Reviewing Stands and Bleachers	100
Roof Loads	(See Section 2305)
Schools—Class Rooms	40
Corridors	100
Sidewalks—800 lbs. Concentrated or	250
Skating Rinks	100
Stairways	100
Storage—Light	125
Heavy (Load to be determined from proposed use or occupancy, but never less than	250
Stores—Retail (Light Merchandise)	75
Wholesale (Light Merchandise)	100

**Sec. 2305.** Roofs having a rise of four (4) inches or less per foot of horizontal projection shall be designed for a vertical live load of thirty (30) pounds per square foot of horizontal projection applied to any or all slopes. Roofs with a rise of more than four (4) inches, and not more than (12)

**Roof Loads**



inches per foot shall be designed for a vertical live load of twenty-five (25) pounds per square foot on the horizontal projection thereof. If the rise exceeds twelve (12) inches per foot no vertical load need be assumed but a wind force of twenty (20) pounds per square foot of such surface acting normal to the roof surface (on one slope at a time) shall be provided for.

**Reduction  
of Live  
Loads**

**Sec. 2306.** The following reductions in assumed live loads shall be permitted in designing of columns, piers, walls, foundations, trusses and girders.

(1) No reduction of the assumed live load shall be allowed in the design of any slabs, joists or beams.

(2) A reduction of the total live load used in the design of girders based on a certain tributary floor area shall be permitted as noted in the following schedule. This reduction shall not be carried into the columns nor shall such reduction be used in design of buildings to be used or occupied as warehouses or for storage purposes.

**Reduction Allowed  
Tributary Floor Area**

5%	100 sq. ft.
10%	200 sq. ft.
15%	300 sq. ft. or more

(3) For determining the total live loads carried by columns the following reductions shall be permitted, the reductions being based on the assumed live loads applied to the entire tributary floor area:

**Allowable Reductions for Warehouses and  
Storage Buildings**

Carrying the roof. . . . .	0 per cent
Carrying 1 floor and roof . . . . .	0 per cent
Carrying 2 floors and roof. . . . .	5 per cent
Carrying 3 floors and roof. . . . .	10 per cent
Carrying 4 floors and roof. . . . .	15 per cent
Carrying 5 floors and roof. . . . .	20 per cent

**Live Load Reductions for Manufacturing Buildings,  
Stores and Garages**

Carrying the roof. . . . .	0 per cent
Carrying 1 floor and roof . . . . .	0 per cent
Carrying 2 floors and roof. . . . .	10 per cent
Carrying 3 floors and roof. . . . .	20 per cent
Carrying 4 or more floors and roof . . . . .	30 per cent

**Allowable Live Load Reductions for All  
Other Buildings**

Carrying the roof. . . . .	0 per cent
Carrying 1 floor and roof . . . . .	0 per cent
Carrying 2 floors and roof. . . . .	10 per cent
Carrying 3 floors and roof. . . . .	20 per cent
Carrying 4 floors and roof. . . . .	30 per cent
Carrying 5 floors and roof. . . . .	40 per cent
Carrying 6 floors and roof. . . . .	45 per cent
Carrying 7 or more floors and roof . . . . .	50 per cent

(4) The base area of the footings of all buildings shall be designed in the following manner: The area of the footing which has the largest percentage of live load to total load shall be determined by dividing the total load by the allowable soil load. From the area thus obtained the dead load soil pressure of such footing is determined and the areas of all other footings of the building shall be determined on the basis of their respective dead loads only and such dead load soil pressure. In no case shall the load per square foot under any portion of any footing, due to the combined dead, live, wind and/or any other loads, exceed the safe sustaining power of the soil upon which the footing rests. The total reduced live load occurring in the column immediately above the footing shall be the live load used in the above computation.

**Sec. 2307.** For purposes of design the wind pressure upon all vertical plane surfaces of all buildings and structures shall be taken at not less than ten (10) pounds per square foot for those portions of the building less than forty (40) feet above ground and at not less than twenty (20) pounds per square foot for those portions more than forty (40) feet above ground.

The wind pressure upon sprinkler tanks, sky signs, or other similar exposed structures and their supports shall be taken as not less than thirty (30) pounds per square foot of the gross area of the plane surface, acting in any direction. In calculating the wind pressure on circular tanks, towers or stacks this pressure shall be assumed to act on six-tenths ( $\frac{6}{10}$ ) of the projected area.

Where it shall appear that a building or structure will be exposed to the full force of the wind throughout its entire height and width, the pressure upon all vertical surfaces thus exposed shall be taken at not less than twenty (20) pounds per square foot.

The overturning moment resulting from the above calculations shall in no case exceed fifty (50) per cent of the dead load resisting moment.

**Sec. 2308.** The live loads for which each floor or part thereof of a commercial or industrial building is or has been designed, shall have such designed live loads conspicuously posted by the owner in that part of each story in which they apply using durable metal signs, and it shall be unlawful to remove or deface such notices. The occupant of the building shall be responsible for keeping the actual load below the allowable limits.

The maximum seating capacity shall be conspicuously posted by the owner of the building by means of durable metal signs placed in each assembly room, auditorium or room used for a similar purpose where fixed seats are not installed, and it shall be unlawful to remove or deface such notice or to permit more than this legal number of persons within such space.

**Sec. 2309.** Plans for other than residential buildings filed with the Building Inspector with applications for permits shall show on each drawing the live loads per square foot of area covered, for which the building is designed, and occupancy permits for buildings hereafter erected shall not be issued until the floor load signs, required by Section 2308, have been installed. No changes in the occupancy of a building now existing or hereafter erected shall be made until a revised occupancy permit has been

**Wind  
Pressure**

**Live Loads  
and Seating  
Capacity  
Posted**

**Occupancy  
Permits for  
Changed  
Floor  
Loading**

## **Secs. 2309-2311**

issued by the Building Inspector certifying that the floors are suitable for the loads characteristic of the proposed occupancy. (See Sections 203 and 204.)

### **Retaining Walls and Basement Floors**

**Sec. 2310.** When earth or water, or earth and water cause or may cause a pressure on any building or structure, such total pressure created shall be calculated in accordance with the best accepted engineering practice, and such calculations and design shall take into account any possible surcharge due to moving or fixed loads.

### **Earthquake Regulations**

**Sec. 2311.** (See Appendix.)

**CHAPTER 24 — MASONRY****(Quality and Design)**

**Sec. 2401.** The quality and design of materials used in the construction of masonry buildings or of the masonry portions of any building shall conform to the minimum standards as specified in this Chapter.

The following materials when used with mortar, and plain concrete and gypsum shall be classed as masonry and wherever used in any building shall conform to the minimum requirements specified in this Chapter.

- (a) Brick (clay, sand lime or concrete).
- (b) Concrete (plain concrete).
- (c) Concrete (block or tile)
- (d) Gypsum.
- (e) Hollow tile (clay).
- (f) Stone.

The Building Inspector may require structural and fire-resistive materials to be subjected to tests to determine their quality whenever there is reason to believe the materials used do not come up to the requirements of this Code and may require any tests to be repeated if there is any reason to believe that the material is no longer up to the specifications on which the approval was based.

Tests of materials shall be made in accordance with the Standard Specifications of the American Society for Testing Materials as such standard specifications are noted in this Chapter.

**Sec. 2402.** Brick as used in this Code shall mean a structural unit of burned clay or shale formed while plastic into a rectangular prism, usually solid and about eight inches by three and three-fourths inches by two and one-fourth inches ( $8'' \times 3\frac{3}{4}'' \times 2\frac{1}{4}''$ ) in size.

Brick shall be divided into three classes, namely: A, B and C, and the classification as to strength of any lot of brick shall be determined by the results of the tests for that strength requirement in which it is lowest. Tests of brick shall be in accordance with Standard Specifications for Tests of Brick, Serial Designation C21-20 of the American Society for Testing Materials. Brick shall be of quality at least equal to one of the three classes noted below.

**Quality of  
Materials  
and Tests  
Required****Brick****Classification of Brick by Strength**

Grades	Compressive Strength (Bricks Flatwise) (lbs. per sq. in.)		Modulus of Rupture (Bricks Flatwise) (lbs. per sq. in.)	
	Mean of Five Tests	Individual Minimum	Mean of Five Tests	Individual Minimum
A	4500 or more	3500	600 or more	400
B	2500 to 4500	2000	450 or more	300
C	1250 to 2500	1000	300 or more	200

## **Secs. 2403-2406**

### **Sand Lime Brick**

**Sec. 2403.** Sand lime brick shall be of quality at least equal to the "medium brick" described in the Standard Specifications, Serial Designation C21-20 of the American Society for Testing Materials; except, that when the average compressive strength of brick grading "soft" by the absorption test is more than twenty-five hundred (2500) pounds per square inch the requirements as to absorption may be waived.

When used for non-bearing purposes and not exposed to the weather brick may be of quality not inferior in any respect to the "soft" brick described in the above specifications.

### **Concrete Brick**

**Sec. 2404.** The average compressive strength of concrete brick twenty-eight (28) days after being manufactured or when delivered on the job, shall be not less than fifteen hundred (1500) pounds per square inch of gross sectional area tested in the position as laid in the wall, and the compressive strength of any individual brick thus tested shall be not less than one thousand (1000) pounds per square inch.

Concrete brick subjected to a twenty-four hour immersion test shall absorb not more than twelve (12) per cent of their dry weight, except that for such brick weighing less than one hundred and twenty-five (125) pounds per cubic foot the average absorption in per cent by weight shall be not more than twelve (12) multiplied by one hundred and twenty-five (125) and divided by the unit weight in pounds per cubic foot of the concrete brick under consideration.

Concrete brick shall conform to the Tentative Specifications for Concrete Building Brick (Serial Designation C54-24T) of the American Society for Testing Materials.

### **Plain Concrete**

**Sec. 2405.** Monolithic concrete construction containing not more than two-tenths ( $\frac{2}{10}$ ) of one (1) per cent of reinforcement shall be classed as plain concrete. Plain concrete in walls and piers shall have a strength of not less than fifteen hundred (1500) pounds per square inch as specified in Section 2606, and such concrete shall be governed by the requirements specified in Chapter 26.

Cement, fine aggregate and coarse aggregate shall conform to the requirements specified in Chapter 26.

### **Hollow Concrete Block or Tile**

**Sec. 2406.** Hollow concrete block or tile shall be of a quality at least equal to either Grade A or B units as specified in this Section.

**Classification of Hollow Concrete Block or Tile**

Grade	Average Compressive Strength on Cross-sectional Area as Laid in Wall (lbs. per sq. in.)	Absorption in 24 Hour Immersion (per cent)
A	1000	8
B	700	10

Grade A hollow concrete block or tile shall have a height of not more than one-half the width of the unit, shall have webs and shells of not less than one and one-half (1 1/2) inches in thickness, and the air spaces in the individual unit shall not exceed one-third of the gross volume of the unit. The concrete used in Grade A units shall comply with the requirements for concrete specified in Chapter 26.

Where concrete block or tile have an average compressive strength of over twelve hundred (1200) pounds per square inch gross area, or where they are not exposed to a dampness, or where they are coated with stucco, the requirements as to absorption may be waived. For block or tile made of concrete weighing less than one hundred and forty (140) pounds per cubic foot, the average absorption in per cent by weight shall be not more than ten (10) multiplied by one hundred and forty (140) and divided by the unit weight in pounds per cubic foot of the concrete under consideration.

Hollow concrete units approved by the Underwriters' Laboratories, Incorporated, Inspection Service and in accordance with the Underwriters' Laboratories Retardent Report No. 1881, issued November 10, 1926, shall be accepted as Grade A units.

Tests on concrete block or tile shall be conducted in accordance with the Standard Specifications, Serial Designation P-1A-26T of the American Concrete Institute.

**Sec. 2407.** Gypsum as used in this Section means a product containing not less than sixty-four and one-half (64 1/2) per cent by weight of calcium sulphate combined with water.

## Gypsum

Neat Gypsum, gypsum fiber concrete or gypsum coarse aggregate concrete used in floor and roof construction of either the reinforced gypsum suspension system or reinforced gypsum in which the gypsum acts structurally shall develop the following minimum ultimate compressive strength in pounds per square inch when dried to constant weight.

- (a) Neat gypsum (as used in pre-cast tile) . . . . . 1800
- (b) Gypsum fiber concrete containing not more than twelve and one-half (12 1/2) per cent by weight of wood chips, excelsior or fiber . . . . 500

Gypsum coarse aggregate concrete of the following volumetric mixes:

- (c) One and one-half (1 1/2) parts gypsum cement;  
one (1) part sand; three (3) parts cinders . . . . . 500
- (d) One and one-half (1 1/2) parts gypsum cement;  
one (1) part sand; three (3) parts slag . . . . . 800
- (e) One and one-half (1 1/2) parts gypsum cement;  
one (1) part sand; three (3) parts gravel . . . . . 800
- (f) One and one-half (1 1/2) parts gypsum cement;  
one (1) part sand; three (3) parts stone . . . . . 800

Note: Compressive tests shall be made on four inch by twelve inch by four inch (4" × 12" × 4") specimens with the load applied to the four inch by twelve inch (4" × 12") face. The average compressive strength shall be not less than noted above and no one specimen shall test less than seventy-five (75) per cent of the average of the lot tested and not less than five (5) samples from the lot shall be tested to determine the average.

Gypsum tile or block used for partitions, walls, furring and enclosures may contain, intimately, mixed, not more than fifteen (15) per cent by weight of binding material consisting of wood chips, excelsior or fiber.

Gypsum partition tile or block shall be equal in quality to that specified in the Standard Specifications for Gypsum Partition Tile and Block, Serial Designation C52-25, of the American Society for Testing Materials.

The chemical and physical properties of the gypsum and calcined gypsum shall be equal to that specified in the Standard Specifications for Gypsum and Calcined Gypsum, Serial Designation C22-25 and C23-22 respectively, of the American Society for Testing Materials.

**Hollow Clay  
Tile**

**Sec. 2408.** Hollow clay tile used for exterior, party, fire or fire division or bearing walls shall be well burned building units of clay or shale and shall have an average compressive strength with cells vertical (end construction) of not less than fourteen hundred (1400) pounds per square inch on the gross area and an average compressive strength with cells horizontally (side construction) of not less than seven hundred (700) pounds per square inch on the gross area. Such average strengths shall be determined by tests of five (5) representative specimens and the minimum strength for any one tile in the lot tested of each type shall be not less than one thousand (1000) pounds per square inch with cells vertical and not less than five hundred (500) pounds per square inch with cells horizontal. All such tile shall have an average absorption of not to exceed sixteen (16) per cent of the dry weight as determined by the one-hour boiling test, and webs and shells shall not be spaced farther apart than three (3) inches center to center in the direction of the wall thickness. The thickness of exterior shells shall be not less than three-fourths ( $\frac{3}{4}$ ) inch.

Tests of hollow clay tile shall be made in conformance with the Standard Specifications and Tests for Hollow Burned-Clay Load-Bearing Wall Tile, Serial Designation C34-26, of the American Society for Testing Materials.

**Mortars**

**Sec. 2409.** All cement and limes used in mortar shall conform to the requirements of the Standard Specifications for these materials issued by the American Society for Testing Materials, having Serial Designations as listed below:

Quicklime for Structural Purposes . . . . .C-5-26  
Hydrated Lime for Structural Purposes . . . . .C6-24  
Specifications for Tests of Portland Cement . . . . .C9-26

All mortar used in exterior and bearing walls, parapet, party, fire and fire division walls and piers shall be either lime-cement mortar or Portland cement mortar; provided, that when such walls are of solid masonry and do not exceed a height of sixteen (16) feet they may be built with lime mortar. Only lime-cement and Portland cement mortars shall be used for walls built of hollow units or built as hollow walls.

Lime Putty for masonry mortar shall be made by slaking to a smooth paste fresh and properly burned quicklime. The resultant paste shall be stored in a suitable box or other receptacle for not less than forty-eight (48)

hours before mixing with sand. Hydrated lime may, in all cases, be substituted for an equivalent amount of lime putty.

(a) Lime mortar shall be composed of one (1) part of lime putty or dry hydrated lime to not over three (3) parts of sand by volume. Portland cement may be added to lime mortar replacing equal volumes of lime putty. When such addition is made the working stress may be increased proportionately up to the stress specified for lime-cement mortar.

(b) Lime-Cement Mortar shall be composed of one (1) part lime putty or dry hydrated lime, one (1) part Portland cement and six (6) parts by volume.

(c) Cement Mortar shall be composed of one (1) part of cement and three (3) parts of sand by volume with an allowable addition of lime putty or hydrated lime of not to exceed fifteen (15) per cent by volume of the cement content.

The above proportions shall be based strictly according to the volume of the constituent parts.

**Sec. 2410.** (a) Brick, sand-lime brick and concrete brick. The maximum allowable working compressive stresses in brick, sand-lime brick and concrete brick masonry due to combined live, dead and other loads shall not exceed the following limits and the strength of the individual units in each class shall conform to the strength requirements as given in Section 2402 for the respective class of working stress.

**Allowable  
Working  
Stresses**

Grades of Units	Maximum Unit Working Stresses (pounds per square inch) Using various mortars		
	Lime Mortar	Lime Cement	Cement Mortar
A	100	180	220
B	100	140	180
C	80	110	125

The above stresses are based on good workmanship with full mortar beds and full mortar joints and shall be allowed only with such construction.

The maximum allowable compressive stresses in hollow walls of brick due to combined live and dead loads, shall not exceed eighty (80) pounds per square inch of gross cross-sectional area when laid with Portland cement mortar, and seventy (70) pounds per square inch of gross cross-sectional area when laid with lime-cement mortar.

(b) Concrete — plain. The maximum allowable working stresses in masonry of plain concrete shall be the following percentages of the ulti-



mate strength of the concrete in compression as determined by the requirements of Chapter 26:

Compression .....	$0.20f'_c$
Shear and diagonal tension .....	$0.04f'_c$

where  $f'_c$  represents the ultimate compressive strength.

(c) Concrete block or tile. The maximum allowable compressive stresses in masonry of concrete block or concrete tile, due to combined live and dead loads, shall not exceed eighty (80) pounds per square inch of gross cross-sectional area when laid with Portland cement mortar, and seventy (70) pounds per square inch of gross cross-sectional area when laid with lime-cement mortar.

(d) Gypsum. Gypsum suspension systems, poured-in place or pre-cast, shall not be less than three (3) inches in thickness, and shall be designed to carry the total estimated dead, live and other loads, with a factor of safety of not less than four (4), and shall be of such character as to be readily calculable by the use of accepted engineering formulas, in which the stress in the suspension wires or cables shall be determined by the formula:

$$T = \frac{wl}{8d} \sqrt{L^2 + 16d^2}$$

where  $T$  is the maximum tension in the cables,  $w$  the load per square foot,  $L$  the clear span between supports in feet and  $d$  the deflection or dip in feet of the wires or cables at the center point of the span as poured in place. The wires or cables used shall be cold-drawn steel in which the allowable working stress shall not exceed twenty thousand (20000) pounds per square inch.

When pre-cast or poured-in-place slabs or tiles or reinforced gypsum in which the gypsum acts structurally, are used, they shall be designed to carry the total dead, live and other loads in accordance with the accepted formulae for reinforced concrete construction as published in the report of the Joint Committee for Concrete and Reinforced Concrete as of August, 1924.

The following working stresses expressed in pounds per square inch shall not be exceeded:

	NEAT GYPSUM	GYPSUM FIBER CONCRETE with not more than 12½ per cent of wood chips, excelsior or fiber	GYPSUM COARSE AGGREGATE CONCRETE
Extreme fiber stress in compression in flexure	350	125	125
Direct compression or bearing	200	100	100
Bond between gypsum and reinforcing	40	30	30
Shearing Stress	30	20	20
Modulus of elasticity in lbs. per square inch	1,000,000	200,000	200,000
Ration of modulus of elasticity of steel to that of gypsum (n).	30	150	150

(e) Hollow tile. The maximum allowable compressive stresses in masonry of hollow tile, due to combined live and dead loads, shall not exceed eighty (80) pounds per square inch of the gross cross-sectional area, when laid with Portland cement mortar, and seventy (70) pounds per square inch of gross sectional area when laid with lime-cement mortar.

(f) Stone. The maximum allowable compressive stresses in rubble stonework, due to combined live and dead loads, shall not exceed one hundred and forty (140) pounds per square inch when laid in Portland cement mortar, nor one hundred (100) pounds per square inch in lime-cement mortar.

**Secs. 2410-2411**

The maximum allowable compressive stress in ashlar masonry due to combined live and dead loads shall not exceed the following limits:

Unit	Maximum Unit Working Stresses (pounds per square inch) laid in	
	Lime Cement Mortar	Portland Cement Mortar
Granite .....	640	800
Limestone .....	400	500
Marble .....	400	500
Sandstone .....	320	400

**General****Requirements**

**Sec. 2411.** The effects of eccentric loads and lateral forces shall be fully analyzed and allowances made for them in design. Concentrated loads shall be distributed so as not to exceed the allowable working stresses as specified in Section 2410 by more than twenty-five (25) per cent.

**CHAPTER 25 — WOOD****(Quality and Design)**

**Sec. 2501.** The quality and design of all wood used in the construction of all buildings or parts of buildings shall conform to the minimum standards as specified in this Chapter.

All members shall be so framed, anchored, tied and braced together as to develop the maximum strength and rigidity necessary for the purpose for which they are used. No member shall be stressed in excess of the strength of its details and connections.

Workmanship in fabrication, preparation, and installation of material shall conform throughout to good engineering practice.

**Sec. 2502.** All wood structural members shall be of sufficient size and strength to carry their imposed loads safely and without exceeding the allowable working stresses as specified in Sections 2503 and 2504.

In computations to determine the required size of timber members the net cross sectional area or actual size shall be used and not the nominal size. Sizes required by this Code shall be deemed to refer to the nominal or commercial description of size unless stated in fractional minimums, and American standard dressed sizes shall be accepted as conforming therewith.

**Sec. 2503.** Lumber used for load supporting purposes, when equivalent in quality to the Basic Provisions of American Lumber Standards for Structural Materials, as published by the Bureau of Standards, Department of Commerce, July, 1926, shall have its safe carrying capacity determined by the working stresses in pounds per square inch of cross sectional area as given in Tables I, II, III, IV, V and VI for the respective grades and locations of use indicated.

For lumber not conforming to, or of quality intermediate between the basic grades, proportionate values for working stresses may be interpolated at the discretion of the Building Inspector.

Lumber of select structural grades may be required to be grade marked or accompanied by a grade certificate.

The allowable stresses given in this Section may be increased not to exceed thirty-three and one-third ( $33\frac{1}{3}$ ) per cent for dead and/or live loads in combination with wind and/or other loads, provided the resulting sections are not less than those required for dead and/or live loads alone.

The allowable stress in compression across the grain may be increased fifty (50) per cent above that specified in this Section for joists supported on a ribbon board and spiked to the adjoining studding.

Douglas Fir (Oregon Pine) conforming in quality to the select grade provisions with the exception of the rate of growth requirements shall have the allowable stress in extreme fiber in bending and compression parallel and perpendicular to the grain reduced one-sixteenth ( $\frac{1}{16}$ ). For materials

**General****Determination  
of Required  
Sizes****Allowable  
Unit  
Stresses**

of common grade which meet the rate of growth requirements of select grade the working stresses in the above properties may be increased one-twelfth ( $1/12$ ). For material of common grade meeting the density requirement the allowable stress in extreme fiber in bending, compression parallel and perpendicular to the grain and horizontal shear may be increased one-fifth ( $1/5$ ).

Shearing stresses for joint details may for all grades given be taken as fifty (50) per cent greater than the horizontal shear values specified in the following tables.

Working values in the following tables are given for three (3) conditions of exposure during use: (a) continuously Dry Locations, (b) Occasionally Wet but quickly dried, (c) more or less continuously damp or usually Wet. The Building Inspector shall determine the values to be used for the existing or proposed conditions of exposure, defined as follows:

(a) Continuously Dry Locations shall apply to use in interior or protected construction, not subject to conditions of excessive dampness or high humidity.

(b) Occasionally Wet but quickly dried shall apply to use in such exterior structures as bridges, trestles, grandstands or bleachers, and exposed framework of open sheds.

(c) More or less continuously damp or Usually Wet shall apply to use where material is exposed to waves of tide water or in contact with earth or used in a building in portions that would be more or less continuously wet.

**TABLE I**  
**Allowable Unit Stresses for Structural Lumber and Timber**  
**Dry Locations**

S P E C I E S	Stress in Pounds per Square Inch					Modulus of Elasticity
	Bending Stress		Compression Stress			
	In Extreme Fiber	Horizontal Shear	Parallel to grain	Perpendicular to grain		
Select Grade						
Cedar, Western Red .....	900	80	700	200	1,000,000	
Cedar, Port Orford .....	1100	90	900	250	1,200,000	
Douglas Fir, Coast Region .....						
(Dense Select) .....	1750	105	1285	380	1,600,000	
Douglas Fir, Coast Region .....	1600	90	1175	345	1,600,000	
Douglas Fir, Rocky Mountain Region .....	1100	85	800	275	1,200,000	
Fir, Golden, Noble, Silver, White .....	1100	70	700	300	1,100,000	
Hemlock, West Coast .....	1300	75	900	300	1,400,000	
Larch, Western .....	1200	100	1100	325	1,300,000	
Pine, California, Idaho, White, Lodgepole, Pondosa and Sugar .....	900	85	750	250	1,000,000	
Redwood .....	1200	70	1000	250	1,200,000	
Spruce, Sitka .....	1100	85	800	250	1,200,000	
Spruce, Engelmann .....	750	70	600	175	800,000	
Common Grade						
Cedar, Western Red .....	720	64	560	200	1,000,000	
Cedar, Port Orford .....	880	72	720	250	1,200,000	
Douglas Fir, Coast Region .....	1200	72	880	325	1,600,000	
Douglas Fir, Rocky Mountain Region .....	880	68	640	275	1,200,000	
Fir, Golden, Noble, Silver, White .....	880	56	560	300	1,100,000	
Hemlock, West Coast .....	1040	60	720	300	1,400,000	
Larch, Western .....	960	80	880	325	1,300,000	
Pine, California, Idaho, White, Lodgepole, Pondosa, and Sugar .....	720	68	600	250	1,000,000	
Redwood .....	960	56	800	250	1,200,000	
Spruce, Sitka .....	880	68	640	250	1,200,000	
Spruce, Englemann .....	600	56	480	175	800,000	

**TABLE II**  
**Allowable Unit Stresses for Structural Lumber and Timber Occasionally Wet**

S P E C I E S	Stress in Pounds per Square Inch					Modulus of Elasticity (All Grades and sizes)
	Bending Stress				Compression Perpen- dicular to Grain (All Grades and sizes)	
	Joist and Plank 4" and Less in Thickness		Beams and Stringers 5" and Thicker			
	In Extreme Fiber	Hori- zontal Shear	In Extreme Fiber	Hori- zontal Shear		
S e l e c t   G r a d e						
Cedar, Western Red .....	710	80	800	80	150	1,000,000
Cedar, Port Orford .....	890	90	1000	90	200	1,200,000
Douglas Fir, Coast Region .....	1370	105	1515	100	265	1,600,000
(Dense Select) .....	1240	90	1385	90	240	1,600,000
Douglas Fir, Coast Region .....	800	85	900	85	225	1,200,000
Douglas Fir, Rocky Mt. Region .....	800	70	.....	.....	200	1,100,000
Fir, Golden, Noble, Silver, White .....	980	75	1100	75	225	1,400,000
Hemlock, West Coast .....	980	100	1100	100	225	1,300,000
Larch, Western .....	710	85	.....	.....	150	1,000,000
Pine, California, Idaho, White, .....	890	70	1000	70	150	1,200,000
Lodgepole, Ponderosa and Sugar .....	800	85	900	85	150	1,200,000
Redwood .....	580	70	.....	.....	140	800,000
Spruce, Sitka .....	C o m m o n   G r a d e					
Spruce, Engelmann .....						
Cedar, Western .....						
Cedar, Port Orford .....	760	72	800	72	200	1,200,000
Douglas Fir, Coast Region .....	980	72	1040	72	225	1,600,000
Douglas Fir, Rocky Mt. Region .....	680	68	720	68	225	1,200,000
Fir, Golden, Noble, Silver, White .....	680	56	.....	.....	200	1,100,000
Hemlock, West Coast .....	830	60	880	60	225	1,400,000
Larch, Western .....	830	80	880	80	225	1,300,000
Pine, California, Idaho, White, .....	600	68	.....	.....	150	1,000,000
Lodgepole, Ponderosa, and Sugar .....	760	56	800	56	150	1,200,000
Redwood .....	680	68	720	68	150	1,200,000
Spruce, Sitka .....	490	56	.....	.....	140	800,000
Spruce, Engelmann .....						

**TABLE III**  
Allowable Unit Stresses for Structural Lumber and Timber Exposed Locations Usually Wet

S P E C I E S	Stress in Pounds per Square Inch					
	Bending Stress				Compression Perpen- dicular to Grain (All Grades and sizes)	Modulus of Elasticity (All Grades and sizes)
	Joist and Plank 4" and Less in Thickness		Beams and Stringers 5" and Thicker			
	In Extreme Fiber	Hori- zontal Shear	In Extreme Fiber	Hori- zontal Shear		
	Select Grade					
Cedar, Western Red .....	670	80	750	80	125	1,000,000
Cedar, Port Orford .....	800	90	900	90	150	1,200,000
Douglas Fir, Coast Region .....	1050	105	1165	100	235	1,600,000
(Dense Select) .....	950	90	1065	90	215	1,600,000
Douglas Fir, Coast Region .....	620	85	700	85	200	1,200,000
Douglas Fir, Rocky Mt. Region .....	710	70	.....	.....	150	1,100,000
Fir, Golden, Noble, Silver, White .....	800	75	900	75	200	1,400,000
Hemlock, West Coast .....	800	100	900	100	200	1,300,000
Larch, Western .....	.....	.....	.....	.....	.....	.....
Pine, California, Idaho, White, Lodgepole, Ponderosa and Sugar .....	670	85	.....	.....	125	1,000,000
Redwood .....	710	70	800	70	125	1,200,000
Spruce, Sitka .....	710	85	800	85	125	1,200,000
Spruce, Engelmann .....	440	70	.....	.....	100	800,000
Common Grade						
Cedar, Western Red .....	680	64	600	64	125	1,000,000
Cedar, Port Orford .....	570	72	720	72	150	1,200,000
Douglas Fir, Coast Region .....	750	72	800	72	200	1,600,000
Douglas Fir, Rocky Mt. Region .....	530	68	560	68	200	1,200,000
Fir, Golden, Noble, Silver, White .....	600	56	.....	.....	150	1,100,000
Hemlock, West Coast .....	680	60	720	60	200	1,400,000
Larch, Western .....	680	80	720	80	200	1,300,000
Pine, California, Idaho, White, Lodgepole, Ponderosa, and Sugar .....	570	68	.....	.....	125	1,000,000
Redwood .....	600	56	640	56	125	1,200,000
Spruce, Sitka .....	600	68	640	68	125	1,200,000
Spruce, Engelmann .....	370	56	.....	.....	100	800,000



## Sec. 2504

### Columns— Allowable Unit Stresses

**Sec. 2504.** Safe unit loads and allowable working stresses in compression parallel to the grain for timber columns of the respective species and for the indicated conditions of exposure shall not exceed in pounds per square inch the values given in the following tables for each ratio of unsupported length to least dimension.

For columns with  $L/d$  intermediate between those which are given in these tables, the safe loads in pounds per square inch may be determined by interpolation.

No column shall be used having a greater unsupported length than fifty (50) times its least dimension.

**TABLE IV**  
Safe Load in Pounds per Square Inch of Cross Sectional Area  
of Square and Rectangular Timber Columns  
Used in Dry Locations

Species	Grade	Working Stresses in Pounds per Square Inch for Various Ratios of Length to Least Dimension ( $L/d$ )										
		10 or less	12	14	16	18	20	25	30	35	40	50
Cedar, Western Red	Select	700	686	674	656	629	592	438	304	224	171	110
	Common	560	553	547	538	524	505	425				
Douglas Fir, Coast Region	D. Select. *	1290	1251	1222	1176	1112	1022	702	487	358	274	175
	Select	1175	1149	1127	1093	1045	975	702				
	Common	881	870	861	847	826	796	675				
Douglas Fir, Rocky Moun-	Select.	800	786	774	753	726	688	526	365	268	206	132
	Common	640	632	627	617	602	682	500				
Hemlock, West Coast	Select	900	885	872	852	823	783	614	426	313	240	153
	Common	720	712	706	696	680	600	573				
Larch, Western	Select	1100	1068	1041	999	937	851	570	396	291	223	142
	Common	880	863	849	822	798	752					
Redwood	Select	1000	972	947	910	856	781	526	365	268	206	132
	Common	800	786	773	754	726	688					
Spruce, Sitka	Select	800	786	774	753	726	688	526	365	268	206	132
	Common	640	632	627	617	602	582	500				

\*Dense Select.

**TABLE V**  
Safe Load in Pounds per Square Inch of Cross Sectional Area  
of Square and Rectangular Timber Columns  
Used in Locations Occasionally Wet but Quickly Dry

Species	Grade	Working Stresses in Pounds per Square Inch for Various Ratios of Length to Least Dimension ( $L/d$ )										
		10 or less	12	14	16	18	20	25	30	35	40	50
Cedar, Western Red	Select	700	686	673	654	628	591	438	304	224	171	110
	Common	560	552	546	537	523	504	425				
Douglas Fir, Coast Region	D. Select.*	1165	1139	1118	1083	1036	967	710	487	358	274	175
	Select Common	1065 800	1045 792	1028 784	1003 773	968 758	915 736	710 644				
Douglas Fir, Rocky Moun- tain Region	Select	800	785	772	753	728	688	526	365	268	206	132
	Common	640	632	625	616	602	582	502				
Hemlock, West Coast	Select	900	885	871	851	824	783	612	426	313	240	153
	Common	720	712	705	695	681	659	572				
Larch, Western	Select	1000	976	955	922	877	810	564	396	291	223	142
	Common	800	787	777	760	736	704					
Redwood	Select	900	879	861	834	794	738	518	365	268	206	132
	Common	720	709	700	685	666	637					
Spruce, Sitka	Select	750	738	728	712	690	657	525	365	268	206	132
	Common	600	594	588	580	568	552	483				

\*Dense Select.

**TABLE VI**  
**Safe Load in Pounds per Square Inch of Cross Sectional Area**  
**of Square and Rectangular Timber Columns**  
**Used in Exposed Locations, Usually Wet**

Species	Grade	Working Stresses in Pounds per Square Inch for Various Ratios of Length to Least Dimension ( <i>L/d</i> )										
		10 or less	12	14	16	18	20	25	30	35	40	50
Cedar, Western Red	Select	650	638	629	614	594	565	437	304	224	171	110
	Common	520	514	509	502	491	475	413				
Douglas Fir, Coast Region	D. Select.*	990	974	961	940	910	871	698	487	358	274	175
	Select	905	893	883	867	846	814	683	487			
	Common	680	675	670	664	655	641	588	482			
Douglas Fir, Rocky Mountain Region	Select	700	690	681	669	651	623	514	365	268	206	132
	Common	560	554	551	544	535	521	465				
Hemlock, West Coast	Select	800	789	780	766	745	717	600	426	313	240	153
	Common	640	634	629	622	612	598	537				
Larch, Western	Select	800	787	776	760	736	704	560	396	291	223	142
	Common	640	633	627	618	606	588	515				
Redwood	Select	750	737	727	712	690	657	525	365	268	206	132
	Common	600	594	588	580	568	552	483				
Spruce, Sitka	Select	650	642	635	625	611	589	500	364	268	206	132
	Common	520	515	512	507	500	489	446				

\*Dense Select.

**Framing  
Details:  
Vertical  
Members**

**Sec. 2505.** (a) Wood columns and posts shall be squared at the ends; shall be provided with base plates and dowels; shall be supported in basements by footings projecting at least two (2) inches above the finished floor; shall be superimposed on approved metal appliances where continuing through more than one story; shall not rest directly or indirectly on any floor beams, except in cases where there is no column below.

(b) Wood bolsters may be used to support a single floor or the roof beams only.

(c) Preservatives shall be applied to column ends where necessary to protect against possible dampness.

(d) Wood columns in basements when built in solid partitions shall be open on at least two (2) sides.

(e) Wood posts, except for minor structures and as piles, shall not be used as foundations below ground.

**Framing  
Details:  
Horizontal  
Members**

**Sec. 2506.** (a) Girders and beams where entering or resting on masonry walls shall have a bearing of at least four (4) inches with the under surface protected by a piece of asphalt saturated felt or paper or a metal bearing plate, or such end may be dipped or painted with creosote.

Where members meet at columns they shall be fitted around or butted up close and held in place by metal strips unless the post caps provide sufficient anchorage.

(b) Built-up timbers shall have members bolted tightly together.

(c) Joists and rafter ends may be supported by a two-inch by four inch (2" × 4") wood strip or cleat spiked or bolted to the girder.

(d) Wood members entering masonry part or fire walls shall be separated from the opposite side of the wall and from beams entering the opposite side of the wall by four (4) inch masonry. The ends of the joists, beams and/or girders shall be splayed or fire-cut to a bevel of not less than three (3) inches in their depth.

(e) Where girders and beams enter masonry they shall be provided with wall plates, boxes or anchors of an approved self-releasing type so arranged as to leave an air space of not less than one (1) inch at sides of member. Rigid boxes shall be provided in concrete walls. The ends of girders shall not be sealed in; provided, that where ends of timbers are well treated with creosote or other approved preservative they may be sealed in.

(f) Anchors for each tier of joists shall be provided where they enter masonry walls and also when they are parallel to masonry walls. Such anchors shall be not less than three-fourths ( $\frac{3}{4}$ ) inch round iron anchors not less than thirty-six (36) inches long fitted with a three-fourths inch by ten-inch ( $\frac{3}{4}$ " × 10") pin at the wall end, and with a two (2) inch hook at the inner end, and shall be spaced not more than six (6) feet apart. The hooks shall be embedded when anchors are placed at the ends of joists, and the pin at the opposite end shall be placed vertically in the wall and four (4) inches from the opposite face of such wall. Such anchors shall in all cases occur on the opposite ends of the same run of joists and ends of joists shall be lapped and spiked so as to form a continuous tie across the building. Anchors shall be placed across the top of joists that run parallel to the wall.

(g) The minimum permissible thickness of joists, rafters and studs shall be one and five-eighths ( $1\frac{5}{8}$ ) inches.

(h) Floor joists shall be supported by girders, bearing partitions or exterior walls. Where entering exterior stud walls, the joists shall be supported by a ribbon let into the studs if no plate is provided. Joists shall be well nailed to the supporting studs. Studs shall be doubled under the ends of doubled joists.

(i) Header joists over six (6) feet long and tail joists over twelve (12) feet long shall be hung in approved stirrup irons or joist hangers.

(j) Joists under bearing partitions and running parallel thereto shall be doubled and well spiked or separated by solid bridging not more than sixteen (16) inches on centers to permit the passage of pipes.

(k) Wood cross bridging shall be placed between joists if the span is over eight (8) feet. The distance between bridging or between bridging and bearing shall not exceed eight (8) feet. Wood cross bridging in dwellings may be three (3) inches in cross sectional area, but in other buildings shall not be less than six (6) inches.

Metal cross bridging of equal or greater strength may be used in place of the wood cross bridging.

(l) Between floor joists crossing bearing partitions solid bridging shall be placed. Solid bridging shall be placed between joists at the edge of flooring when the attic space is only partially covered.

(m) Cutting of wood girders, beams or joists shall be limited to cuts and bore holes not deeper than one-fifth ( $\frac{1}{5}$ ) the beam depth below its top located not further from the beam end than three (3) times the beam depth. Cuts in excess of above or bore holes with a diameter more than two (2) inches are not permitted without special provisions for framing the beams approved by the Building Inspector.

**Sec. 2507.** (a) Stud partitions shall be provided with soles or plates with dimensions not less than the studs where the partition studs do not rest on walls, girder beams, or do not pass through the floor to the top plate at the partition below.

(b) In bearing partitions the top plate shall be doubled and lapped at each intersection. Joints in the upper and lower members of the top plate shall be staggered not less than two (2) feet.

(c) Studs in bearing partitions and walls shall not be less than two inches by four inches ( $2'' \times 4''$ ) in size. Where a bearing partition supports more than the weight of the roof and one floor the studs shall be not less than two inches by six inches ( $2'' \times 6''$ ) or three inches by four inches ( $3'' \times 4''$ ) except that underpinning may be of the same size as the studs immediately above when such underpinning is not more than four (4) feet in height.

(d) Where studs pass through from floor to floor they shall be fire-stopped at point of passage through floors.

(e) Angles at corners where stud walls or partitions meet shall be framed solid so no lath can extend from one room to another. All exterior and main cross stud partitions shall be effectively and thoroughly angle braced.

(f) Stud partitions containing plumbing, heating or other pipes shall be so framed and the joists underneath so spaced as to give proper

**Framing  
Details:  
Stud  
Walls  
and  
Partitions**

clearance for the piping. Where a partition containing such piping runs parallel to the floor joists, the joists underneath such partitions shall be doubled and spaced to permit the passage of such pipes and shall be bridged with solid bridging. Where plumbing, heating or other pipes are placed in or partly in a partition necessitating the cutting of the soles or plates, a metal tie not less than one-eighth ( $\frac{1}{8}$ ) inch thick and one and one-half ( $1\frac{1}{2}$ ) inches wide shall be fastened to the plate across and to each side of the opening with not less than four (4) sixteen-penny (16-d.) nails.

(g) Openings in stud partitions and walls shall be framed around with double studs at each side and double headers across the top resting on the short stud at each end. The double header shall be placed on edge and shall be trussed above for all openings over four (4) feet in width or where more than two (2) studs are cut away.

(h) Wood lath, furring or framing shall be placed not less than two (2) inches from any chimney and not less than four (4) inches from the back of any fireplace.

(i) Where wood partitions and masonry walls join, bolts ten (10) inches long with two-inch by five-inch by one-fourth inch ( $2'' \times 5'' \times \frac{1}{4}''$ ) iron plate washers shall be built into the masonry wall opposite each line of fire blocking and near the top, top plate or ribbon in each partition. The projecting end of the bolt shall pierce the partition and be securely fastened thereto.

**Roof  
Framing**

**Sec. 2508.** (a) Valley rafters shall be not less than one and five-eighths by five and one-half inches ( $1\frac{5}{8}'' \times 5\frac{1}{2}''$ ) in size.

(b) Flashings shall be placed around all openings in and extensions of mechanical appliances or equipment through the roof.

(c) Anchors for joists and rafters shall be provided where they enter masonry walls and also where they are parallel to masonry walls as specified for joists in Section 2506 (f).

**Framing  
Details:  
Trusses**

**Sec. 2509.** (a) Wood trusses and truss framing shall have all joints accurately cut and fitted together so that each bearing is true and drawn tight to the full bearing. All such trusses shall be properly secured in place by lateral bracing.

(b) Washers of sufficient size to distribute the loads properly shall be used in connection with rods or metal members. Before a truss is loaded, the tension rods shall be well tightened.

(c) Timber trusses shall be securely anchored to the wall at points of bearing.

**Fire  
Stops**

**Sec. 2510.** (a) Fire stops shall be provided at all intersections of interior and exterior walls with floors, ceilings and roof in such a manner as to effectively cut off communication by fire through hollow concealed spaces and prevent both vertical and horizontal drafts.

(b) Furred walls shall have fire stopping placed immediately above and below the junction of any floor construction with the walls or shall be fire-stopped the full depth of the joist.

(c) All stud walls or partitions shall have a continuous row of bridging or fire stopping which shall form a complete and effective separation in the entire width of partition at that point, placed in such a

manner that there shall be no concealed air spaces greater than seven (7) feet in any dimension. Fire stops shall be the full width of the studding and sufficiently stiff to act as lateral bracing for the individual studs.

(d) Stair stringers shall be fire-stopped at least once in the middle portion of each run, and shall be fire-stopped by a header beam at the top and bottom, so as to effectively prevent the passage of fire. Full width fire clocking shall be placed between studs along and in line with the run of stairs adjoining such partitions.

(e) When sliding doors are pocketed in partitions, such pockets shall be completely fire-stopped at end, sides, top and bottom.

(f) All spaces between chimneys and wood framing shall be solidly filled with refuse mortar, loose cinders or other incombustible material placed in incombustible supports.

(g) All fire-stopping as required in this Section shall be not less than two (2) inches in thickness and not less in width than the enclosed space within the partition except as provided in paragraph (f) hereof for chimneys.

(h) All attic spaces or spaces between ceilings and the underside of roofs shall be divided into horizontal areas of not more than twenty-five hundred (2500) square feet with tight one-inch (1") partitions of matched wood or of approved incombustible materials. All openings through these partitions shall be protected by self-closing doors of the same thickness and materials as the partition.



## **CHAPTER 26 — REINFORCED CONCRETE QUALITY AND DESIGN**

<b>Quality</b>	<b>Sec. 2601.</b> The quality of the materials used in reinforced concrete and the quality of reinforced concrete shall conform to the physical and chemical properties as specified in Section 2604.
<b>Design</b>	<b>Sec. 2602.</b> The design of reinforced concrete shall conform to the rules and principles specified in this Chapter.
<b>Definitions</b>	<p><b>Sec. 2603.</b> The following definitions give the meaning of certain terms as used in this Chapter.</p> <p><b>Anchorage</b>—The embedment in concrete of a portion of a reinforcement bar, either straight or with hooks, designed to prevent pulling out or slipping of the bar when subjected to stress. (The anchorage of tension reinforcement in beams includes only the embedded length beyond a point of contraflexure or of zero moment.)</p> <p><b>Column</b>—An upright compression member, the length of which exceeds three times its least lateral dimension. (See Pedestal.)</p> <p><b>Column Capital</b>—An enlargement of the upper end of a reinforced concrete column designed and built to act as a unit with the column and flat-slab.</p> <p><b>Concrete</b>—A mixture of Portland cement, fine aggregate, coarse aggregate and water.</p> <p><b>Deformed Bar</b>—(See Section 2604-d.)</p> <p><b>Effective Area of Reinforcement</b>—The area obtained by multiplying the right cross-sectional area of the metal reinforcement by the cosine of the angle between its direction and that for which the effectiveness of the reinforcement is to be determined.</p> <p><b>Flat Slab</b>—(See Section 2620.)</p> <p><b>Gunite</b>—A mixture of Portland cement and fine aggregate, mixed dry, passed through a cement gun, hydrated at the nozzle and deposited under pressure in its place of final repose, and shall be considered as concrete for particulars of design as specified in Chapter 26.</p> <p><b>Laitance</b>—Extremely fine material of little or no hardness which may collect on the surface of freshly deposited concrete or mortar, resulting from the use of excess mixing water and usually recognized by its relatively light color.</p> <p><b>Mortar</b>—A mixture of Portland cement, fine aggregate and water.</p> <p><b>Negative Reinforcement</b>—Reinforcement so placed as to take tensile stress due to negative bending moment.</p> <p><b>Panel Length</b>—The distance in either direction between centers of two columns of a panel, other than a diagonal direction.</p> <p><b>Pedestal</b>—An upright compression member whose height does not exceed three times its least lateral dimension.</p> <p><b>Plain Concrete</b>—(See Section 2405.)</p> <p><b>Portland Cement</b>—The product obtained by finely pulverizing clinker produced by calcining to incipient fusion an intimate and properly proportioned mixture of argillaceous and calcareous materials, with no additions</p>

subsequent to calcination excepting water and calcined or uncalcined gypsum.

**Positive Reinforcement**— Reinforcement so placed as to take tensile stress due to positive bending moment.

**Ratio of Reinforcement**— The ratio of the effective area of the reinforcement cut by a section of a beam or slab to the effective area of the concrete cut by that section.

**Reinforced Concrete**— Concrete in which metal is embedded in such a manner that the two materials act together in resisting forces.

**Sec. 2604.** (a) Portland cement shall conform to the Standard Specifications and Tests for Portland Cement (Serial Designation C9-26) of the American Society for Testing Materials.

## Materials

(b) Concrete aggregates shall consist of natural sands, gravels, crushed rock, air-cooled blast-furnace slag, or other inert materials having clean, strong, durable, uncoated particles and shall meet the approval of the Building Inspector. Aggregates containing soft, friable, thin, flaky, elongated or laminated particles totaling more than three (3) per cent by weight; or containing shale in excess of one and one-half ( $1\frac{1}{2}$ ) per cent, or silt and crusher dust finer than the No. 100 standard sieve in excess of two (2) per cent shall not be used. These percentages shall be used on the weight of the combined aggregate as used in the concrete. When all three groups of these injurious materials are present in the aggregate, the combined amounts shall not exceed five (5) per cent by weight, of the combined aggregate. Aggregates shall not contain strong alkali, or organic material which gives a color darker than the standard color when tested in accordance with the standard colorimetric test of the American Society for Testing Materials.

The maximum size of the aggregate shall not be larger than one-fifth ( $\frac{1}{5}$ ) of the narrowest dimension between forms of the member for which the concrete is to be used nor larger than three-fourths ( $\frac{3}{4}$ ) of the minimum clear spacing between reinforcing bars, or between bars and forms. Maximum size of aggregate is defined as the clear space between the sides of the smallest square opening through which ninety-five (95) per cent by weight, of the material can be passed.

(c) Water used in mixing concrete shall be clean and free from injurious amounts of oil, acid, alkali, organic matter or other harmful substances.

(d) Metal reinforcement shall conform to the requirements of the Standard Specifications (Serial Designation A15-14) for Billet-Steel Concrete Reinforcement Bars of structural, intermediate or hard grade or Standard Specifications (Serial Designation A16-14) for Rail-Steel Concrete Reinforcement Bars, Standard Specifications of the American Society for Testing Materials, or Tentative Specifications for Cold-Drawn Steel Wire for Concrete Reinforcement (Serial Designation A82-21T); provided, that hard grade billet-steel bars larger than three-fourths ( $\frac{3}{4}$ ) inch in diameter shall not be used where bending would be required; and provided, further, that the requirement in the above mentioned specifications for machining of deformed bars shall be eliminated.

Deformed bars, to receive that rating which permits the use of higher bond stresses than allowed for plain bars, shall show a bond strength twenty-five (25) per cent greater than that shown by plain bars of equivalent cross-sectional area.

(e) Storage of cement and aggregates shall be in a manner to prevent deterioration or the intrusion of foreign matter. Any material which has been damaged shall be immediately and completely removed from the work.

**Test of  
Materials**

**Sec. 2605.** On concrete or reinforced concrete work the Building Inspector shall have the right to require the owner or his agent to make tests of the concrete from time to time to determine whether the materials and methods in use are such as to produce concrete or reinforced concrete of the quality specified and used in the design of the building or structure. The tests shall be made when ordered by the Building Inspector by the owner or his authorized representative and no responsibility for the expense of these tests shall attach to the Building Department. All such tests shall be made by competent persons approved by the Building Inspector and copies of the results shall be kept on file in the office of the Building Inspector for a period of not less than two years after the acceptance of the structure. Specimens of such tests shall be taken at the place where the concrete is being deposited and shall be taken, cured and tested in accordance with the Standard Specifications C31-21 of the American Society for Testing Materials.

**Quality of  
Concrete**

**Sec. 2606.** Provisions for the design of structures embodied in this Chapter are based on the presumption of concrete of certain strength. To produce concrete of the required strength, the proportion of the mixing water to the cement shall be accurately controlled except that the ratios of water to cement suggested in this Section shall not apply to gunite.

The strengths of concrete indicated in the following table are the minimum ultimate strengths that may be expected of Portland cement concrete when using the tabulated ratios of water to cement and when the concrete is cured and tested as specified in Section 2605, but in all cases the strength used in the design shall be the ultimate measure and determining factor. Water or moisture contained in the aggregates must be included in determining the ratio of water to cement.

**Approximate Proportions of Mixing Water to Cement**

Strengths (Lbs. per sq. in.)	Water-Cement Ratio (U.S. Gal. of Water per cu. ft. of Cement)
1,500	8 1/4
2,000	7 1/4
2,500	6 1/2
3,000	5 3/4
(See Appendix)	

All structural drawings and plans submitted for approval shall show the proposed strength of concrete to be used and the water-cement ratio assumed to produce that strength, but the concrete produced and used shall develop a strength in twenty-eight (28) days not less than that shown on the plans as assumed in the design.

**Sec. 2607.** The proportions of aggregates to cement for concrete of any water-cement ratio shall be such as to produce concrete that will work readily into the corners and angles of the form and around the reinforcement without excessive puddling or spading and without permitting free water to collect on the surface. The combined aggregates shall be of such composition of sizes that when separated by the No. 4 standard sieve, the weight retained on the sieve shall not be less than one-half ( $1/2$ ) nor more than two-thirds ( $2/3$ ) of the total, nor shall the amount of coarse material be such as to produce harshness in placing or honeycombing in the structure. When forms are removed, the faces and corners of the members shall be smooth and sound throughout.

Admixtures of lime or finely pulverized inert materials may be added but not in excess of six (6) per cent by volume of the cement used.

## Proportions and Consistency

**Sec. 2608.** The methods of measuring concrete materials shall be such that the proportion of water to cement can be accurately controlled during the progress of the work and easily checked at any time by the Building Inspector or his authorized representative. A tolerance of one-fourth ( $1/4$ ) gallon of water per sack of cement in any batch of concrete will be allowed provided that the average for any ten (10) consecutive batches does not show a water content greater than that shown in the table and on plans as specified in Section 2606.

The method of delivering the aggregates to the work and of storing and handling shall be such that the moisture content of the aggregates as they come to the mixer shall not be subject to frequent or unnecessary changes.

## Control of Proportions

**Sec. 2609. (a) Mixing.** The concrete shall be mixed until there is a uniform distribution of the materials and the mass is uniform in color and homogeneous. In machine mixing, only batch mixers shall be used. Each batch shall be mixed not less than one minute after all the materials are in the mixer and must be completely discharged before the mixer is recharged. Machine mixers shall have a peripheral speed of approximately two hundred (200) feet per minute.

**(b) Cleaning Forms and Equipment.** Before concrete is placed all equipment for mixing and transporting the concrete shall be cleaned, all debris shall be removed from the spaces to be occupied by the concrete, forms shall be thoroughly wetted (except in freezing weather) or oiled, and masonry that will be in contact with concrete shall be well drenched (except in freezing weather). Reinforcement shall be thoroughly cleaned and secured in position. Concrete shall not be placed until the forms and reinforcement have been inspected and accepted by the "Registered Inspector."

**(c) Removal of Water From Excavations.** Water shall be removed from excavations before concrete is deposited, unless otherwise directed by the Building Inspector. Any flow of water into an excavation shall be

## Mixing and Placing Concrete

diverted through proper side drains to a sump, or be removed by other approved methods which will avoid washing the freshly deposited concrete. Water vent pipes and drains shall be filled by grouting or otherwise, after the concrete has thoroughly hardened.

(d) **Transporting Concrete.** Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which shall prevent the separation or loss of the ingredients. It shall be deposited as nearly as practicable in its final position to avoid rehandling or flowing. Under no circumstances shall concrete that has attained its initial set be used.

(e) **Placing.** Concrete shall be thoroughly compacted with suitable tools. When necessary, openings shall be provided in the forms to permit the placing of concrete in such a manner as to avoid accumulations of hardened concrete on the forms or reinforcing bars. The concrete shall be thoroughly worked around the reinforcement.

(f) **Curing.** Exposed surfaces of concrete shall be kept moist for a period of at least seven (7) days after being deposited.

(g) **Depositing in Cold Weather.** When depositing concrete at freezing or near freezing temperatures, the concrete shall be maintained at a temperature of at least fifty (50) deg. F., but not more than one hundred twenty (120) deg. F. The concrete shall be maintained at a temperature of not less than fifty (50) deg. F. for not less than seventy-two hours after placing. When necessary, concrete materials shall be heated before mixing. Dependence shall not be placed on salt or other chemicals for the prevention of freezing.

(h) **Bonding Fresh and Hardened Concrete.** Before new concrete is deposited on or against concrete which has set, the forms shall be retightened, the surface of the set concrete shall be roughened, cleaned of foreign matter and laitance and thoroughly wetted but not saturated. The cleaned and wetted surfaces of the hardened concrete, including vertical and inclined surfaces, shall first be slushed with a coating of 1:2 cement mortar against which the new concrete shall be placed before the mortar has attained its initial set.

**Forms and  
Details of  
Construction**

**Sec. 2610. (a) Design of Forms.** Forms shall conform to the shape, lines and dimensions of the member as called for on the plans and shall be substantial and sufficiently tight to prevent leakage of mortar. They shall be properly braced or tied together so as to maintain position and shape. If adequate foundation for shores cannot be secured, trussed supports shall be provided.

Forms shall be so designed, braced and aligned as to keep the finished columns of the building plumb with not more than an error of 1 to 1,000 in the height of the exterior columns or of columns adjacent to elevators.

Temporary openings shall be provided at the base of column and wall forms, and at other points where necessary, to facilitate cleaning and inspection.

(b) **Removal of Forms.** Forms shall not be disturbed until the concrete has hardened sufficiently to permit their removal with safety. Shoring shall not be removed until the member has acquired sufficient strength to support safely its own weight and the load upon it. Members subject to additional loads during construction shall be adequately shored to support both the member and construction loads in a manner that will protect the member from damage.

The Building Inspector may require forms to remain in place for a specified time.

(c) **Cleaning and Bending Reinforcements.** Metal reinforcement before being placed shall be thoroughly cleaned of loose mill and rust scale and of other coatings that will destroy or reduce the bond. Reinforcement shall be carefully formed to the dimensions indicated on the plans. Cold bends shall be made around a pin having a diameter of not less than four times the least dimension of the bar.

Metal reinforcement shall not be bent, straightened or handled in a manner that will injure the material. Bars with kinks or bends not shown on the plans shall not be used. Heating of reinforcement will be permitted only when approved by the Building Inspector.

(d) **Placing Reinforcement.** Metal reinforcement shall be accurately placed and secured and shall be supported by chairs, spacers, or hangers. The minimum clear distance between parallel bars shall be one and one-half ( $1\frac{1}{2}$ ) times the diameter for round bars or one and one-half ( $1\frac{1}{2}$ ) times the diagonal for square bars. The minimum clear distance between bars and forms shall be the diameter of round bars and the diagonal of square bars. If the ends of bars are anchored as specified in Section 2619, the clear spacing may be made equal to the diameter of round bars or to the diagonal of square bars, but in no case shall the spacing between bars be less than one (1) inch, nor less than one and one-third ( $1\frac{1}{3}$ ) times the maximum size of the coarse aggregate. Bars shall be embedded a distance from any face of any member not less than the minimum distance as specified in Section 4301. The main longitudinal slab steel shall be spaced not more than two and one-half ( $2\frac{1}{2}$ ) times the slab thickness. Not less than one-tenth ( $\frac{1}{10}$ ) of one (1) per cent of transverse steel shall be provided.

(e) **Splices and Offsets in Reinforcement.** In slabs, beams and girders, splices of reinforcement shall not be made at points of maximum stress without the approval of the Building Inspector. Splices, where permitted, shall provide sufficient lap to transfer the stress between bars by bond and shear. In such splices the bars shall be spaced at the minimum distance specified in paragraph (d) of this Section.

Where changes in the cross-section of a compression member occur, the longitudinal bars shall be sloped for the full length of the member or offset in a region where lateral support is afforded. Where offset, the slope of the inclined portion from the axis of the member shall not be more than 1 in 6.

(f) **Protective Covering of Concrete.** At the under side of footings metal reinforcement shall have a minimum covering of three (3) inches of concrete.

In fire-resistive construction, metal reinforcement shall be protected as specified in Section 4301.

Exposed reinforcement bars intended for bonding with future extensions shall be protected from corrosion.

(g) **Construction Joints.** Joints not indicated on the plans shall be so made and located as to least impair the strength of the completed structure. Where a joint is to be made, any excess water and laitance shall be removed from the surface after concrete is deposited. Before depositing of concrete is resumed the hardened surface shall be treated as specified in paragraph (h) of Section 2609.

At least one hour must elapse after concrete is deposited in the columns or walls before depositing in beams, girders, or slabs supported thereon. Haunches and column capitals shall be considered as part of, and to act continuous with, the floor.

Construction joints in floors shall be located near the middle spans of slabs, beams or girders, unless a beam intersects a girder at this point, in which case the joints in the girders shall be offset a distance equal to twice the width of the beam. Provisions shall be made for shear by use of reinforcement, inclined in both directions across the joint.

**Assumptions  
for Design**

**Sec. 2611.** The design of reinforced concrete members shall be based on the following assumptions:

- (a) Calculations shall be made with reference to working stresses and safe loads;
- (b) A plane section before bending remains plane after bending, shearing distortions being neglected;
- (c) The modulus of elasticity of concrete in compression is constant within the limits of working stresses, and the distribution of compressive stress in beams is rectilinear;
- (d) The moduli of elasticity of concrete in computations for the position of the neutral axis, for the resisting moment of beams and for compression of concrete in columns, are as follows:

	Moduli of Elasticity	Compressive Strength of Concrete at 28 days
(1)	1/15 that of steel	1,500 to 2,200 lbs. per sq. in.
(2)	1/12 that of steel	2,200 to 2,900 lbs. per sq. in.
(3)	1/10 that of steel	2,900 or more lbs. per sq. in.

(e) In calculating the moment of resistance of reinforced concrete beams and slabs the tensile resistance of the concrete is neglected;

(f) The bond between the concrete and the metal reinforcement remains unbroken throughout the range of working stresses. Under compression the two materials are therefore stressed in proportion to their moduli of elasticity;

(g) Initial stress in the reinforcement due to contraction or expansion of the concrete is neglected except in the design of reinforced concrete columns.

**Notation**

**Sec. 2612.** The symbols and notations used in this Chapter are defined as follows:

- $a$  = width of face of column or pedestal;  
 $\alpha$  = angle between inclined web bars and axis of beam;  
 $A$  = total net area of column, footing, or pedestal, exclusive of fireproofing;  
 $A'$  = loaded area of pedestal, pier or footing;  
 $A_c = A (1-p)$  net area of concrete core of column (core area minus reinforcement);  
 $A'_c$  = net area of concrete in columns with lateral ties (total column area minus area of reinforcement);  
 $A_s$  = effective cross-sectional area of metal reinforcement in tension in beams or compression in columns; and the effective cross-sectional area of metal reinforcement which crosses any of the principal design sections of a flat-slab and which meets the requirements of paragraph (1) of Section 2620;  
 $A_v$  = total area of web reinforcement in tension within a distance of  $s$  ( $s_1$ ,  $s_2$ ,  $s_3$ , etc.) or the total area of all bars bent up in any one point;  
 $b$  = width of rectangular beam or width of flange of T-beam;  
 $b_1$  = dimension of the dropped panel of a flat-slab in the direction parallel to  $l_1$ ;  
 $c$  = base diameter of the largest right circular cone which lies entirely within the column (including the capital) whose vertex angle is 90 deg. and whose base is one and one-half ( $1\frac{1}{2}$ ) inches below the bottom of the slab or the bottom of the dropped panel, (in flat-slab formulae);  
 $c$  = projection of footing from face of column (in footing formulae);  
 $d$  = depth from compression surface of beam or slab to center of longitudinal tension reinforcement;  
 $d'$  = depth from compression surface of a beam or slab to center of compression reinforcement;  
 $E_c$  = modulus of elasticity of concrete in compression;  
 $E_s$  = modulus of elasticity of steel = 30,000,000 lb. per sq. in.;  
 $f_c$  = compressive unit stress in extreme fiber of concrete;  
 $f'_c$  = ultimate compressive strength of concrete at age of twenty-eight (28) days, determined by tests made in accordance with Section 2605;  
 $f_r$  = compressive unit stress in metal core;  
 $f_s$  = tensile unit stress in longitudinal reinforcement;  
 $f_v$  = tensile unit stress in web reinforcement;  
 $F$  = total tension in a bar;  
 $F'$  = total tensile stress in a bar developed in the length "y", (see paragraph (c) of Section 2619);  
 $h$  = unsupported length of column (see paragraph (b) Section 2621);  
 $I$  = moment of inertia of a section about the neutral axis for bending;  
 $j$  = ratio of lever arm of resisting couple to depth  $d$ ;  
 $k$  = ratio of depth of neutral axis to depth  $d$ ;  
 $l$  = span length of beam or slab (see paragraph (b) Section 2614);  
 $l$  = span length of flat-slab, center to center of columns, in the direction in which moments are considered;



$l_1$  = span length of flat-slab, center to center of columns, perpendicular to the direction in which moments are considered;  
 $M$  = bending moment or moment of resistance in general;  
 $M_o$  = sum of positive and negative bending moments in either direction, at the principal design sections of a panel of a flat-slab;  
 $n = E_s / E_c$  ratio of modulus of elasticity of steel to that of concrete;  
 $\Sigma_o$  = sum of perimeters of bars in one set;  
 $p$  = ratio of effective area of tension reinforcement to effective area of concrete in beams  $= A_s / bd$ ; and the ratio of effective area of longitudinal reinforcement to the area of the concrete core in columns;  
 $P$  = total safe axial load on column whose  $h/R$  is less than 40;  
 $P'$  = total safe axial load on long column;  
 $r_a$  = permissible working stress in concrete over the loaded area of a pedestal, pier or footing;  
 $R$  = ratio of positive or negative moment in two column strips or one middle strip of a flat slab, to  $M_o$  (in flat-slab formulae);  
 $R$  = least radius of gyration of a section;  
 $s$  = spacing of web members, measured at the mid-depth of the beam and in the direction of the longitudinal axis of the beam;  
 $t$  = thickness of flange of T-beam;  
 $t_1$  = thickness of flat-slab without dropped panels or thickness of a dropped panel;  
 $t_2$  = thickness of flat-slab with dropped panels at points away from the dropped panel;  
 $u$  = bond stress per unit of area of surface of bar;  
 $v$  = shearing unit stress;  
 $V$  = total shear;  
 $w$  = uniformly distributed load per unit of length of beam or slab;  
 $w$  = upward reaction per unit of area of base of footing (in footing formulae);  
 $w'$  = uniformly distributed dead and live load per unit of area of a floor or roof;  
 $W$  = total dead and live load uniformly distributed over a single panel area;  
 $x$  = length of bar added for anchorage, including the hook, if any;  
 $y$  = distance from the point at which the tension is computed to the point of beginning of anchorage;

**Working  
Stresses**

**Sec. 2613.** As specified in Section 2606, the structural drawings and plans shall show the ultimate strength of concrete for which the several parts of the structures were designed. The working stresses for the design of buildings or structures shall be based on the ultimate strength indicated on the drawings as specified in Section 2606 and shall be in the ratios specified in this Chapter. The ultimate strength ( $f'_c$ ) shall be the average strength attained at twenty-eight (28) days, based on six by twelve inch (6"  $\times$  12") or eight by sixteen inch (8"  $\times$  16") cylinders made, cured and

tested in accordance with the Standard Methods of Making and Storing Specimens of Concrete in the Field (Serial Designation C31-21) and Standard Methods of Making Compression Tests of Concrete (Serial Designation C39-25) of the American Society for Testing Materials. Guniting test cylinders shall be made in a manner that will permit the blast of air to firmly compact the materials and provide proper escapement of the air to eliminate possible back pressure, and such cylinders shall be cured and tested as specified above.

Working stresses in concrete and reinforcement are summarized as follows:

### MAXIMUM ALLOWABLE STRESSES

#### CONCRETE: (a) Compression

1. Columns: varies (See paragraphs (c) and (d) Section 2621)
2. Long Columns: (See paragraph (h) Section 2621)
3. Piers and Pedestals, . . . . .  $0.25f'_c$
4. Extreme Fibre, positive bending . . . . .  $0.40f'_c$
5. Extreme Fibre, negative bending . . . . .  $0.45f'_c$
- (b) Shear: (1) *Beams without special anchorage of longitudinal reinforcement.*
6. No web reinforcement . . . . .  $0.02f'_c$
7. Stirrups and/or bent-up bars . . . . .  $0.06f'_c$
- (2) *Beams with special anchorage of longitudinal reinforcement.*
8. No web reinforcement . . . . .  $0.03f'_c$
9. Stirrups and/or bent-up bars . . . . .  $0.12f'_c$
- Note: Web reinforcement in beams where the shear exceeds  $0.06f'_c$  shall be subject to the approval of the Building Inspector and in no case shall the maximum unit shearing stress exceed 240 lbs. per sq. in.
- (3) *Flat-slabs.*
10. At distance  $d$  from edge of column cap or dropped panel . . . . .  $0.03f'_c$
- (4) *Footings.*
11. Same as 6.
12. Same as 8.
- (c) **Bond:** (1) *Plain Bars.*
13. Beams and slabs, and one-way footings . . . . .  $0.04f'_c$
14. Two-way footings . . . . .  $0.03f'_c$
- (2) *Deformed Bars.*
15. Beams and slabs, and one-way footings . . . . .  $0.05f'_c$
16. Two-way footings . . . . .  $0.0375f'_c$

#### STEEL:

17. Billet-steel bars:
    - Structural grade . . . . . 16,000 lbs. per sq. in.
    - Intermediate grade . . . . . 18,000 " " " "
    - Hard grade (where permitted) . . . . . 20,000 " " " "
  18. Rail-steel bars . . . . . 20,000 " " " "
  19. Ordinary reinforcing bars . . . . .  $nf_c$
  20. Structural steel core of composite column . . . . . 16,000 lbs. per sq. in.
- (See paragraph (f) of Section 2621 for reduced stresses)

21. Structural steel column . . . . . 16,000 lbs. per sq. in.  
(See paragraph (g) of Section 2621 for reduced stresses)
22. Composite cast-iron column . . . . . 10,000 lbs. per sq. in.  
(See paragraph (f) of Section 2621 for reduced stresses)
23. Cold drawn steel wire . . . . . 20,000 lbs. per sq. in.

**Flexural Computations**

**Sec. 2614.** (a) Formulas for Flexure. Computations of flexural resistance of reinforced concrete beams and slabs shall be based on the assumptions of Section 2611. The customary formulas or their equivalent shall be used.

(b) Span Length. The span length of freely supported beams and slabs shall be the clear span plus the depth of beam or slab but shall not exceed the distance between centers of the supports.

The span length for continuous or restrained beams built to act integrally with supports shall be the clear distance between faces of supports. For continuous or restrained beams having brackets built to act integrally with both beam and support and of a width not less than the width of the beam and making an angle of 45 deg. or more with the horizontal, the span may be measured from the section where the combined depth of the beam and bracket is at least one-third ( $\frac{1}{3}$ ) more than the depth of the beam. No portion of such a bracket shall be considered as adding to the effective depth of the beam. Maximum negative moments are to be considered as existing at the ends of the span, as defined above.

In rectangular slabs reinforced in both directions the distribution of load shall be assumed to be inversely as the cubes of the spans.

(c) Unsupported Length of Beams. The distance between lateral supports of the compression area of a beam shall not exceed twenty-four (24) times the least width of compression flange.

(d) Requirements for T-Beams. In T-beam construction the slab shall be built integral with the beam. The effective flange width to be used in the design of symmetrical T-beams shall not exceed one-fourth ( $\frac{1}{4}$ ) of the span length of the beam, and its overhanging width on either side of the web shall not exceed eight (8) times the thickness of the slab, and never more than one-half ( $\frac{1}{2}$ ) the clear distance to the next beam.

For beams having a flange on one side only, the effective flange width to be used in design shall not exceed one-tenth ( $\frac{1}{10}$ ) of the span length of the beam, and its overhanging width from the face of the web shall not exceed (6) times the thickness of the slab, and never more than one-half ( $\frac{1}{2}$ ) the clear distance to the next beam.

Where the principal slab reinforcement is parallel to the beam, transverse reinforcement, not less in amount than three-tenths (0.3) per cent of the sectional area of the slab, shall be provided in the top of the slab and shall extend across the beam and into the slab not less than two-thirds ( $\frac{2}{3}$ ) of the width of the effective flange overhang. The spacing of the bars shall not exceed eighteen (18) inches.

Provision shall be made for the compressive stress at the support in continuous T-beam construction.

The overhanging portion of the flange of the beam shall not be considered as effective in computing the shear and diagonal tension resistance of T-beams.

Isolated beams in which the T-form is used only for purpose of providing additional compression area shall have a flange thickness not less than one-half ( $1/2$ ) the width of the web and a total symmetrical flange width not more than four (4) times the web thickness.

**Sec. 2615.** Beams and slabs of equal spans freely supported or built to act integrally with beams, girders or other slightly restraining support, or beams and slabs built into masonry walls in a manner which develops only partial end restraint, and carrying uniformly distributed loads, shall be designed for the following moments at critical sections:

**Moment  
Coefficients:  
Freely  
Supported,  
Slightly  
Restrained**

- (a) Beams and slabs of one span,  
Maximum positive moment near center,  
 $M = wl^2/8$  ..... (1)
- (b) Beams and slabs continuous for two spans only,
  - (1) Maximum positive moment near center,  
 $M = wl^2/10$  ..... (2)
  - (2) Negative moment over interior support,  
 $M = wl^2/8$  ..... (3)
- (c) Beams and slabs continuous for more than two spans,
  - (1) Maximum positive moment near center and  
negative moment at support of interior spans,  
 $M = wl^2/12$  ..... (4)
  - (2) Maximum positive moment near centers of end spans and  
negative moment at first interior support,  
 $M = wl^2/10$  ..... (5)
- (d) Negative moment at end supports for cases (a), (b) and (c)  
of this Section.  
 $M = \text{not less than } wl^2/16$  ..... (6)

**Sec. 2616.** Beams and slabs of equal span built to act integrally with columns, walls, or other restraining supports and assumed to carry uniformly distributed loads, shall be designed, except as provided in Section 2615, for the following moments at critical sections:

**Moment  
Coefficients:  
Fully  
Restrained**

- (a) Interior spans,
  - (1) Negative moment at interior supports except the first,  
 $M = wl^2/12$  ..... (7)
  - (2) Maximum positive moment near centers of interior spans,  
 $M = wl^2/16$  ..... (8)
- (b) End spans of continuous beams and slabs, and beams and slabs of one span in which  $l/l$  is less than twice the sum of the values of  $l/h$  for the exterior columns above and below which are built into beams;
  - (1) Maximum positive moment near center of span and negative  
moment at first interior supports,  
 $M = wl^2/12$  ..... (9)
  - (2) Negative moment at exterior supports,  
 $M = wl^2/12$  ..... (10)
- (c) End spans of continuous beams, and beams of one span, in which  $l/l$  is equal to or greater than twice the sum of the values of  $l/h$  for the exterior columns above and below which are built into the beams:
  - (1) Maximum positive moment near center of span and negative  
moment at first interior support,

$$M = wl^2/10 \dots\dots\dots(11)$$

(2) Negative moment at exterior support,  
 $M = wl^2/16 \dots\dots\dots(12)$

In this section “*I*” represents the moment of inertia which for these calculations shall be computed on the assumption that the member is homogeneous, neglecting the reinforcement but including that part of the concrete section outside of the reinforcement which is ordinarily considered as fireproofing.

**Moment  
Coefficients:  
Unequal  
Spans,  
Non-uniform  
Loads**

**Sec. 2617.** Continuous beams or slabs with unequal spans or with other than uniformly distributed loading, whether freely-supported or restrained, shall be designed for the actual moments under the conditions of loading and restraint.

Provision shall be made where necessary for negative moment near the center of short spans which are adjacent to long spans, and for the negative moment at the end supports, if restrained.

**Shear and  
Diagonal  
Tension**

**Sec. 2618.** (a) The shearing unit stress,  $v$ , in reinforced concrete slabs, joists, beams and girders shall be computed by Formula 14 on the minimum width of rectangular beams and on the minimum web thickness in L or T-beams.

$$v = V/bjd. \dots\dots\dots(14)$$

(b) Types of web reinforcement may consist of vertical or inclined stirrups or web reinforcing bars forming an angle of 30 deg. or more with the axis of the beam, or longitudinal bars bent up at an angle of 15 deg. or more with the axis of the beam, and shall be anchored at both ends as specified in paragraph (e) of Section 2619.

(c) Spacing of stirrups or bent-up bars shall not exceed the values given by Formula 15, where the shearing stress is not greater than  $0.06f'_c$ .

$$s = \frac{45d}{\alpha + 10} \dots\dots\dots(15)$$

Bent-up bars and stirrups shall be considered effective in reinforcing the web only within the area between two vertical planes distant  $s/2$  in either direction from the point where the bent-up bar crosses the mid-depth of the beam.

Where the shearing stress is greater than  $0.06f'_c$  the distance  $s$  shall be not greater than two-thirds ( $2/3$ ) of the values given by Formula 15.

(d) Maximum shearing unit stresses computed by Formula 14, in beams where the longitudinal reinforcement is without special anchorage, shall not exceed the value given by Formula 16 and in no case shall it exceed  $0.06f'_c$ .

$$v = 0.02f'_c + \frac{f_v A_v}{bs} (\sin \alpha + \cos \alpha) \dots\dots\dots(16)$$

In beams in which the longitudinal reinforcement is anchored as specified in paragraph (e) of Section 2619, the shearing unit stress shall not

exceed the value given by Formula 16 when  $0.03f'_c$  is substituted for  $0.02f'_c$ , and in no case shall it exceed 240 lbs. per sq. in.

Where the entire web reinforcement consists of longitudinal bars bent up in a single plane the allowance for the quantity,

$$\frac{f_v A_v}{bs} (\sin \alpha + \cos \alpha) \text{ in Formula 16, shall not exceed 75.}$$

(e) Combined web reinforcement shall be assumed to have a total shearing resistance of the sum of the shearing resistances computed of the various types separately, the shearing resistance of the concrete being included only once.

(f) Shearing unit stresses in flat-slabs, computed by Formula 14 (in which  $d$  shall be taken as  $t_1 - 1\frac{1}{2}$ ) on a vertical section which lies at a distance  $t_1 - 1\frac{1}{2}$  from the edge of the column capital and parallel with it, shall not exceed  $0.02f'_c$  multiplied by the following factor: 1 plus the ratio which the cross-sectional area of the negative reinforcement in the width of strip directly above the column capital bears to the cross-sectional area of the negative reinforcement in the full width of two column strips. At least twenty-five (25) per cent of the total cross-sectional area of the negative reinforcement in two column strips must be within the width of strip directly above the column capital.

In no case shall the unit shearing stress exceed  $0.03f'_c$ .

The shearing unit stress, computed by Formula 14 (in which  $d$  shall be taken as  $t_2 - 1\frac{1}{2}$ ) on a vertical section which lies at a distance of  $t_2 - 1\frac{1}{2}$  from the edge of the dropped panel and parallel with it, shall not exceed  $0.03f'_c$ . At least fifty (50) per cent of the cross-sectional area of the negative reinforcement in two column strips must be within the width of strip directly above the dropped panel.

(g) Shear and diagonal tension in footings shall be taken as not less than that computed by Formula 14, and at the critical section shall not exceed  $0.02f'_c$  for footings with straight bars nor  $0.03f'_c$  for footings in which the bars are anchored at both ends by adequate hooks as specified in paragraph (e) of Section 2719.

The critical section for diagonal tension in footings on soil shall be computed on a vertical section through the perimeter of the lower base of a frustrum of a cone or pyramid which has a base angle of 45 deg., and which has for its top the base of the column or pedestal and for its lower base the plane at the centroid of longitudinal reinforcement.

The critical section for diagonal tension in footings on piles shall be computed on a vertical section at the inner edge of the first row of piles entirely outside a section midway between the face of the column or pedestal and the section defined for soil footings, but in no case outside of that section. For piles not arranged in rows, the critical section shall be taken midway between the face of the column and the section defined for soil footings.

**Bond and Anchorage**

**Sec. 2619.** (a) Bond stresses in beams where bar reinforcement is used to resist tensile stresses developed by beam action shall be taken as not less than that computed by Formula 17.

$$u = V/\Sigma_o jd \dots\dots\dots(17)$$

For continuous or restrained members, the critical section for bond for the positive reinforcement shall be assumed to be at the point of inflection; that for the negative reinforcement shall be assumed to be at the face of the support, and at the point of inflection. For simple beams or at the outer ends of freely supported end spans of continuous beams, the critical section for bond shall be assumed to be at the face of the support.

Bent-up longitudinal bars, which, at the critical section, are within a distance  $d/3$  from horizontal reinforcement under consideration may be included with the straight bars in computing  $\Sigma_o$ .

(b) Permissible bond stress where ordinary anchorage as described in paragraph (d) of this Section is provided, shall not exceed the values specified in Section 2613.

(c) Permissible bond stress where special anchorage is provided, as described in paragraph (e) of this Section, shall not exceed two and one-half ( $2\frac{1}{2}$ ) times that specified in paragraph (b) of this Section. A sufficient additional length of bar shall be added beyond the theoretical point of zero moment to provide for the development of the excess in bond stress of that specified in paragraph (b) of this Section. The length  $x$  to be added for this purpose is expressed by Formula 18.

$$xu\Sigma_o = F - F' \dots\dots\dots(18)$$

The point of beginning of anchorage shall be taken at the edge of support for freely supported beams and at the point of inflection for fixed or continuous beams. Anchorage of negative reinforcing shall be toward the center of the beams from this point.

The length of bar added for anchorage may be either straight or bent. The radius of bend shall be not less than four (4) bar diameters.

(d) Ordinary anchorage in continuous, restrained or cantilever beams shall be the length of anchorage of the tensile negative reinforcement beyond the face of the support and shall provide for the full maximum tension by Formula 18. Such anchorage shall provide a length of bar not less than the depth of the beam. In the case of end supports which have a width less than three-fourths of the depth of the beam, the bars shall be bent down toward the support a distance not less than the effective depth of the beam. The portion of the bar so bent down shall be as near to the end of the beam as protective covering permits. In continuous or restrained beams, negative reinforcement shall be carried to or beyond the point of inflection. Not less than one-fourth of the area of the positive reinforcement shall extend into the support to provide an embedment of ten (10) or more bar diameters.

In simple beams or at the outer ends of freely supported end spans of continuous beams at least one-fourth of the area of the tensile reinforce-

ment shall extend along the tension side of the beam and beyond the face of the support to provide an embedment of ten (10) or more bar diameters.

(e) Special anchorage in addition to that required in paragraph (d) of this Section shall be provided as specified in this paragraph where increased shearing stresses are used as provided in paragraphs (c), (f) and (g) of Section 2618, or where increased bond stresses are used as provided in paragraph (c) of this Section.

(1) In continuous and restrained beams, anchorage beyond points of inflection of at least one-third the area of the negative reinforcement and beyond the face of the support of at least one-third the area of the positive reinforcement, shall be provided to develop one-third of the maximum working stress in tension. The anchorage length  $x$  shall be computed by Formula 18, with bond stresses not greater than those specified in paragraph (b) of this section.

(2) At the edges of footings, anchorage for all the bars for one-third the maximum working stress in tension shall be provided within a region where the tension in the concrete, computed as an unreinforced beam, does not exceed 40 lbs. per sq. in. In any case the reinforcement bars shall extend to within four (4) inches of the edge of the footing but not closer than three (3) inches as specified in paragraph (f) of Section 2610.

(3) In simple beams or at the outer ends of freely supported end spans of continuous beams, at least one-half of the tensile reinforcements shall extend along the tension side of the beam to provide an anchorage beyond the face of the support for one-third of the maximum working stress in tension.

(f) Anchorage of web reinforcement at both ends shall be by providing continuity with longitudinal reinforcement, bending around the longitudinal bar or by means of a semi-circular hook which has a radius not less than four (4) times the diameter of the web bar.

Stirrup anchorage shall be so provided in the compression and tension regions of a beam as to permit the development of safe working tensile stress in the stirrup at a point  $0.3d$  from either face.

The end anchorage of a web member not in bearing on the longitudinal reinforcement shall be such as to engage an amount of concrete sufficient to prevent the bar from pulling out. In all cases the stirrups shall be carried as close to the upper and lower surfaces as fireproofing requirements permit.

**Sec. 2620. (a) Limitations.** Flat-slab construction shall refer to concrete slabs having reinforcement bars extending in two or four directions, without beams or girders to carry the load to supporting members and with a ratio of length to width of panel not greater than 1.4. The moment coefficients, moment distribution and slab thicknesses specified herein are for slabs which have three or more rows of panels in each direction, and in which the panels are approximately uniform in size. Slabs with paneled

#### **Flat-Slab Construction**



ceiling or with depressed paneling in the floor shall be considered as coming under the requirements herein given, provided the depth of the thicker portion of the slab does not exceed 1.5 times the depth of the remainder of the slab.

(b) Panel Strips and Principal Design Section. A flat-slab panel shall be considered as consisting of strips as follows:

A middle strip one-half panel in width, symmetrical with respect to the panel center line and extending through the panel in the direction in which moments are being considered;

Two Column Strips, each one-quarter panel in width, occupying the two (2) quarter-panel areas outside of the middle strip.

When considering moments in the direction of the width of the panel, the panel is similarly divided by strips, the width of which are respectively one-half and one-fourth of the length of the panel.

The principal design sections are located as follow:

Sections for Negative Moment shall be taken along the edges of the panel; that is, along the lines joining the column centers. For the column strips, the section shall follow the center line between the columns to the edge of the column capital and then around the circumference of the column capital for one-quarter ( $1/4$ ) circumference.

Sections for Positive Moment shall be taken on the center line of the panel, crossing the strips for which moments are being considered.

(c) Moments in Interior Panels. Flat-slabs in which the ratio of reinforcement,  $p$ , for negative moment in the column strip is not greater than 0.01, the numerical sum of the positive and negative moments in the direction of either side of a rectangular panel shall be not less than that given by Formula 19.

$$M = 0.09 Wl (1 - 2c/3l)^2 \dots\dots\dots(19)$$

(d) Moments in Principal Design Sections. The moments in the principal design sections shall be those given in the accompanying table of moments, except as follows:

(1) The sum of the maximum negative moments in the two column strips may be greater or less than the values given in the table of moments by not more than  $0.03M_o$ .

(2) The maximum negative and the maximum positive moments in the middle strip and the sum of the maximum positive moments in the two column strips may be greater or less than the values given in the table of moments by not more than  $0.01M_o$ .

# BENDING MOMENTS TO BE USED IN DESIGN OF FLAT SLABS

For Interior Panels Fully Continuous

Strip	Flat-Slabs without Dropped Panels		Flat-Slabs with Dropped Panels	
	Negative	Positive	Negative	Positive
Slabs with 2-way Reinforcement				
Column strip	$0.23 M_o$	$0.11 M_o$	$0.25 M_o$	$0.10 M_o$
2-Column strips	$0.46 M_o$	$0.22 M_o$	$0.50 M_o$	$0.20 M_o$
Middle strip	$0.16 M_o$	$0.16 M_o$	$0.15 M_o$	$0.15 M_o$
Slabs with 4-way Reinforcement				
Column strip	$0.25 M_o$	$0.10 M_o$	$0.27 M_o$	$0.095 M_o$
2-Column strips	$0.50 M_o$	$0.20 M_o$	$0.54 M_o$	$0.190 M_o$
Middle strip	$0.10 M_o$	$0.20 M_o$	$0.08 M_o$	$0.190 M_o$

(e) Lateral Dimensions of Dropped Panels. The dropped panel shall have a length or diameter in each direction parallel to a side of the panel of not less than one-third the panel length in that direction.

(f) Thickness of Slabs and Dropped Panels. The total thickness of the slab through the dropped panel,  $t$ , in inches, or of the slab if a dropped panel is not used, shall be not less than the value given by Formula 20.

$$t_1 = 0.038 (1 - 1.44 c/l) l \sqrt{Rw' l_1 / b_1 + 1^{1/2}} \dots \dots \dots (20)$$

Note: The values of  $R$  in the above formula are the coefficients of  $M_o$  in the preceding table in this Section.

For slabs with dropped panels the total thickness in inches at points beyond the dropped panel shall be not less than

$$t_2 = 0.02 \sqrt{w'} + 1 \dots \dots \dots (21)$$

The dropped panel shall have a thickness of  $t_1$  not greater than  $1.5t_2$ .

In determining minimum thickness by Formulas 20 and 21, the value of  $l$  shall be the panel length center to center of the columns, on the long side of panel and the value of  $l_1$  shall be the panel width, center to center of the columns.

The slab thickness  $t_1$  or  $t_2$  shall in no case be less than  $l/32$  for floor slabs, and not less than  $l/40$  for roof slabs.

(g) Wall and Other Irregular Panels. In wall panels and other panels in which the slab is not continuous with an adjacent panel, the maximum negative moment at the edge of the panel opposite to the discontinuous edge and the maximum positive moment at the center of this panel shall be increased fifteen (15) per cent in the column strip perpendicular to the wall or discontinuous edge and thirty (30) per cent in the middle strip perpendicular to the wall or discontinuous edge. Such increase refers to the moments for interior panels as specified in paragraph (d) of this Section.

In these strips the bars used for positive moments perpendicular to the discontinuous edge shall extend to the edge of the panel at which the slab is discontinuous.

At the wall or discontinuous edge the negative moment in the column

strip shall be taken as not less than ninety (90) per cent and in the middle strip as not less than sixty-five (65) per cent of the corresponding moments for a normal interior panel as given in the table in paragraph (d) of this Section.

(h) **Panels with Marginal Beams.** A marginal beam which has a depth greater than the thickness of the dropped panel into which it frames, shall be designed to carry, in addition to the load superimposed directly upon it, a uniformly distributed load equal to at least one-fourth of the total live and dead load for which the adjacent panel or panels are designed. Slabs supported by marginal beams on opposite edges shall be designed as freely supported slabs for the entire load.

Column strips adjacent to and parallel with marginal beams having a depth less than the thickness of the dropped panel, shall be designed to resist the moment specified for a column strip in the table of moments. Column strips adjacent to and parallel with marginal beams having a depth less than the thickness of the dropped panel, shall be designed to resist a moment at least one-half as great as that specified for a column strip in the table of moments.

In wall columns where brackets are used in place of capitals, the value of  $c$  in the direction in which the bracket extends shall be taken as twice the distance from the center of the column to a point one and one-half ( $1\frac{1}{2}$ ) inches back from the edge of the bracket and averaged with the value of  $c$  for an interior column capital in the computation for moments in Formula 19. The value of  $c$  for column strips parallel and adjacent to marginal beams shall be taken as equal to the width of the wall column if no bracket is used in this direction.

(i) **Flat-Slabs on Bearing Walls.** Where there is a beam or a bearing wall at the center line of columns in the interior portion of a continuous flat slab, the negative moment at the beam or wall line in the middle strip perpendicular to the beam or wall shall be taken as thirty (30) per cent greater than the negative moment specified in the table of moments in paragraph (d) of this Section for a middle strip. The column strip adjacent to and lying on either side of the beam or wall shall be designed to resist moments at least one-half of those specified in the table of moments for a column strip.

(j) **Points of Inflection.** In the middle strip the point of inflection for the slabs without dropped panels shall be assumed at a line  $0.30\ l$  distant from the center of the span, and for slabs with dropped panels  $0.25\ l$  distant from the center of the span.

In the column strip the point of inflection for slabs without dropped panels shall be at a line  $0.30\ (l-c)$  distant from the center of the panel and  $0.25\ (l-c)$  for slabs with dropped panels.

(k) **Effective Reinforcement.** The reinforcement which crosses any section and which fulfills the requirements given in paragraph (l) of this Section may be considered as effective in resisting the moment at the section. The sectional area of a bar multiplied by the cosine of the angle between the direction of the axis of the bar and any other direction may be considered effective as reinforcement in that direction.

(l) **Arrangement of Reinforcement.** The reinforcement shall be securely fastened in place. All bars in rectangular or diagonal directions shall be carried to points at least twenty (20) diameters beyond the point of inflection on each side of a section of critical, positive, or negative moment. Lapped splices shall not be permitted at or near regions of maximum stress except as described in paragraph (e) of Section 2610. At least four-tenths (0.4) of all bars in each direction shall be of such length and shall be so placed as to provide reinforcement at two sections of critical negative moment and at the intermediate section of critical positive moment. Not less than one-third of the bars used for positive reinforcement in the column strip shall extend into the dropped panel at least twenty (20) diameters of the bar, or in case no dropped panel is used, shall extend to within one-eighth ( $1/8$ ) of the span length from the center line of the column or the support.

(m) **Special Panel Arrangement.** For structures having a width of less than three rows of panels, or in which irregular or special panels are used, an analysis shall be made of the moments developed in both slabs and columns.

**Sec. 2621. (a) Limiting Dimensions.** Reinforced concrete columns shall be not longer than forty (40) times the least radius of gyration, unless designed as long columns as specified in paragraph (h) of this Section. Principal columns shall have a minimum gross diameter of not less than twelve (12) inches.

### Reinforced Concrete Columns

(b) **Unsupported Length and Radius of Gyration of Columns.** The unsupported length of reinforced concrete columns shall be:

- (1) In flat-slab construction the clear distance between the floor and under side of the capital or dropped panel above;
- (2) In beam-and-slab construction, the clear distance between the floor and the under side of the shallowest beam framing into the column at the next higher floor level;
- (3) In floor construction with beams in one direction only, the clear distance between floor slabs;
- (4) In columns supported laterally by struts or beams only, the clear distance between consecutive pairs (or groups) of struts or beams, provided that to be considered an adequate support, two such struts or beams shall meet the column at approximately the same level and the angle between the two planes formed by the axis of the column and the axis of each strut respectively is not less than seventy-five (75) deg. nor more than one hundred five (105) deg.

When haunches are used at the junction of beams or struts with columns, the clear distance between supports may be considered as reduced by two-thirds of the depth of the haunch.

The radius of gyration of a column shall be computed from the concrete area of the core and the transformed section of the longitudinal steel area. That is, the actual area of the steel multiplied by  $n$ , this being assumed to be distributed uniformly around the periphery of the core.

(c) Design of Spiral Columns. The safe axial load on columns reinforced with longitudinal bars and closely spaced spirals enclosing a circular core, shall be not greater than that determined by Formula 22.

$$P = A [1 + (n-1)p] [300 + (0.10 + 4p)f'_c] \dots \dots \dots (22)$$

The longitudinal reinforcement shall consist of at least six bars of minimum diameter of one-half (1/2) inch, and the total effective cross-sectional area shall be not less than one (1) per cent nor more than six (6) per cent of that of the core.

The spiral reinforcement shall be not less than one-fourth (1/4) the volume of the longitudinal reinforcement. It shall consist of evenly spaced continuous spirals held firmly in place and true to line by at least three vertical spacer bars. The spacing of the spirals shall be not greater than one-sixth (1/6) of the diameter of the core and in no case more than three (3) inches.

Reinforcement shall be protected by a covering of concrete, cast monolithic with the core, of a thickness not less than that specified in Section 4301.

(d) Design of Columns with Lateral Ties. The safe axial load on columns reinforced with longitudinal bars and separate lateral ties shall be not greater than that determined by Formula 23.

$$P = (A'_c + A_s n) f_c \dots \dots \dots (23)$$

$f_c$  shall not exceed  $0.20f'_c$ .

The amount of longitudinal reinforcement shall be not less than five-tenths (0.5) per cent nor shall the amount considered in the calculations be more than two (2) per cent of the total area of the column. The longitudinal reinforcement shall consist of not less than four bars of minimum diameter of one-half (1/2) inch and shall be protected by a covering of concrete, cast monolithic with the column, of a thickness not less than that specified in Section 4301.

Lateral ties shall be at least one-quarter (1/4) inch in diameter, spaced not more than eight (8) inches apart and the points of successive ties shall be placed in rotation around the column.

(e) Bending in columns. The bending moments in interior and exterior columns shall be determined on the basis of loading conditions and end restraint and shall be provided for in the design.

In flat-slab construction, a bending moment at all interior columns equal to  $W_1 l / 40$  shall be assumed to cover all ordinary cases of unequal loading in floors and roofs. In this formula  $W_1$  = the total live load on one panel and  $l$  = the span, center to center of columns, lengthwise to the panels. Known eccentric loads and uneven spacing of columns shall be provided for in the design. Resistance to these bending moments shall be provided in the columns immediately above and below in direct proportion to the values of their ratios of  $l/h$  (See Section 2616 and paragraph (b) of this Section). In columns supporting roofs the moment shall be resisted by the column below.

Wall columns in flat-slab construction shall be designed to resist bending in the same manner as interior columns except that the total live and dead load in the panel shall be used instead of the live load only when

computing the moment. Any counter moment due to the weight of the structure that projects beyond the column center line may be deducted from the moment computed as just described.

The limiting unit stresses due to the combined axial load and bending shall be determined as follows:

(1) With Spiral Reinforcement—The compressive unit stress at the extreme fibre on the concrete within the core area under combined axial load and bending shall not exceed the value given by the expression  $300 + (0.10 + 4p)f'_c$ .

(2) With Lateral Ties—Additional longitudinal reinforcement may be used if required to provide for the bending stresses, and the compressive unit stress at the extreme fibre on the concrete under combined axial load and bending may be increased to  $0.30f'_c$ . The column section, however, shall be not less than that required by the provisions of paragraph (d) of this Section where axial load alone is considered. The total amount of reinforcement considered in the computations for combined stress shall be not more than four (4) per cent of the total area of the column.

(f) Composite Columns. The safe load on composite columns in which a structural steel or cast-iron column is thoroughly encased in a circumferentially reinforced concrete core shall be based on a unit stress of  $0.25f'_c$  on the area within the spiral core plus the unit compressive stress on the steel or cast-iron core as determined by Formulae 24 and 25 respectively.

$$f_r = \frac{18,000}{1 + \frac{h^2}{18,000R^2}} \dots\dots\dots (24)$$

but shall not exceed 16,000 lbs. per sq. in.

$$f_r = 12,000 - 60 h/R \dots\dots\dots (25)$$

but shall not exceed 10,000 lbs. per sq. in.

The diameter of the cast-iron section shall not exceed one-half of the diameter of the core within the spiral. The spiral reinforcement shall be not less than five-tenths (0.5) per cent of the volume of the core within the spiral and shall conform in quality, spacing and other requirements to the provisions for spirals in paragraph (c) of this Section.

Ample section of concrete and continuity of reinforcement shall be provided at the junction with beams or girders. The area of the concrete between the spiral and the metal core shall be not less than that required to carry the total floor load of the story above on the basis of a stress in the concrete of  $0.35f'_c$  unless special brackets are arranged on the metal core to receive directly the beam or slab load.

(g) Structural Steel Columns. The safe load on a structural steel column of a section which fully encases an area of concrete and which is protected by an outside shell of concrete at least three (3) inches thick, shall be computed in the same manner as for composite columns in paragraph (f) of Section 2621, allowing  $0.25f'_c$  on the area of the concrete enclosed by the steel section. The outside shell shall be reinforced by wire mesh weighing not less than two-tenths (0.2) lbs. per sq. ft. or by ties or spirals of

equal weight, and with a spacing of not more than six (6) inches between strands or hoops. Special brackets shall be used to receive the entire floor load at each story. The safe load in steel columns calculated by Formula 24 shall not exceed 16,000 lbs. per sq. in.

(h) Long Columns. The permissible working load on the core in axially loaded columns which have a length greater than forty (40) times the least radius of gyration of the column core ( $40R$ ) shall be not greater than that determined by Formula 26.

$$P' = P (1.33 - h/120 R) \dots\dots\dots(26)$$

**Footings**

**Sec. 2622.** (a) General. The requirements for flexure, shear and bond of Sections 2614 to 2619, inclusive, shall govern the design of footings, except as hereinafter provided.

(b) Loads. Footings resting directly on soil or on piles shall be proportioned as to area or number of piles on the basis of the total column load plus the weight of the footing itself. For computations of moments and shears, an upward reaction per unit area or per pile shall be based on the total column load (not including the weight of the footing itself) divided by the area or by the number of piles.

(c) Sloped or Stepped Footings. Footings in which the thickness has been determined by the requirements for shear as specified in paragraph (g) of Section 2618 may be sloped or stepped between the critical section and the edge of the footing; provided, that the shear on no section outside the critical section exceeds the value specified; and provided further, that the thickness of the footing above the reinforcement at the edge shall be not less than six (6) inches for footings on soil, nor less than twelve (12) inches for footings on piles. Sloped or stepped footings shall be cast as a unit.

(d) Bending in Footings. The critical section for bending in a concrete footing which supports a concrete column or pedestal shall be considered to be at the face of the column or pedestal. Where steel or cast-iron column bases are used, the moment in the footing shall be computed at the middle and at the edge of the base. The load shall be considered as uniformly distributed over the column or pedestal base.

The bending moment at the critical section in a square footing supporting a concentric square column shall be computed from the load on the trapezoid bounded by one face of the column, the corresponding outside edge of the footing, and the portions of the two diagonals. The load on the two corner triangles of this trapezoid shall be considered as applied at a distance from the face equal to six-tenths of the projection of the footing from the face of the column. The load on the rectangular portion of the trapezoid shall be considered as applied at its center of gravity. The bending moment is expressed by Formula 27.

$$M = w/2(a + 1.2c)c^2 \dots\dots\dots(27)$$

For a round or octagonal column, the distance  $a$  shall be taken as equal to the side of a square of an area equal to the area enclosed within the perimeter of the column.

The sectional area of reinforcement shall be distributed uniformly across the footing unless the width is greater than the diameter of the column or pedestal plus twice the effective depth of the footing, in which case the

width over which the reinforcement is spread may be increased to include one-half the remaining width of footing. Additional reinforcement with a spacing double that within the effective belt shall be placed outside of the width specified, but such reinforcement shall not be considered as effective in resisting the calculated bending moment.

The extreme fibre stress in the concrete and steel shall be kept within the limits specified in Section 2613.

(e) **Footings Other than Square.** A rectangular or irregularly shaped footing shall be computed by dividing it into rectangles or trapezoids tributary to the sides of the column, using the distance to the center of gravity of the area as the moment arm of the upward forces. Outstanding portions of combined footings shall be treated in the same manner. Other portions of combined footings shall be designed as beams or slabs.

(f) **Shearing and Bond Stresses.** See paragraph (g) of Section 2618 and paragraphs (a) and (e) of Section 2619.

(g) **Transfer of Stress at Base of Column.** The compressive stress in longitudinal reinforcement at the base of a column shall be transferred to the pedestal or footing by either dowels or distributing bases. When dowels are used they shall be of the same size and number as the reinforcing bars in the columns. The dowels shall extend into the column and into the pedestal or footing not less than fifty (50) diameters for plain bars or forty (40) diameters for deformed bars.

When metal distributing bases are used, they shall have sufficient area and thickness to transmit safely the load from the longitudinal reinforcement in compression and bending. The permissible compressive unit stress on top of the pedestal or footing directly under the column shall be not greater than that determined by Formula 28.

$$r_a = 0.25f'_c \sqrt{A/A'} \dots\dots\dots (28)$$

In sloped or stepped footings  $A$  may be taken as the area of the top horizontal surface of the footing or as the area of the lower base of the largest frustum of a pyramid or cone contained wholly within the footing and having for its upper base the loaded area  $A'$ , and having side slopes of one (1) vertical to two (2) horizontal.

(h) **Pedestals without Reinforcement.** The allowable compressive unit stress on the gross area of a concentrically loaded pedestal or on the minimum area of a pedestal footing shall not exceed  $0.25f'_c$  unless reinforcement is provided and the member designed as a reinforced concrete column.

The depth of a pedestal or pedestal footing shall be not greater than three times its least width and the projection on any side from the face of the supported member shall be not greater than one-half the depth. The depth of a pedestal whose sides are sloped or stepped shall not exceed three times the least width or diameter of the section midway between the top and bottom. A pedestal footing supported directly on piles shall have a mat of reinforcing bars having a cross-sectional area of not less than two-tenths (0.2) sq. in. per foot in each direction, placed three (3) inches above the top of the piles.



**CHAPTER 27—STEEL AND IRON****(Quality and Design)****Quality and  
Design**

**Sec. 2701.** The quality and design of all structural steel and iron used in buildings shall conform to the requirements specified in this Chapter.

Structural steel shall be of such quality as to conform to Standard Specifications for Structural Steel for Buildings, Serial Designation A9-24, of the American Society for Testing Materials.

Cast steel used in buildings and/or structures shall be of such quality as to conform with the Standard Specifications for Steel Castings, Serial Designation A27-24, of the American Society for Testing Materials.

Cast iron used in buildings and/or structures shall be of such quality as to conform with the Standard Specifications for Gray Iron Castings, Serial Designation A48-18, of the American Society for Testing Materials.

All structural steel shall be tested in accordance with the above specifications when deemed necessary by the Building Inspector and copies of such tests shall be filed in the office of the Building Inspector. No structural steel shall be used in any building or structure which does not comply with the above requirements or for which no test results have been filed with the Building Inspector. All steel tests shall be made by competent testing laboratories and at the expense of the owner.

The computations and design shall be properly made so that the unit working stresses specified in this Chapter are not exceeded. The structure and its details shall possess the requisite strength and rigidity for proper stability and the design of every structural frame shall be such as to admit of a rational analysis according to well established principles of mechanics and sound engineering practice.

All structural steel sections shall be straight and true and any section so damaged as to affect its proper carrying capacity shall not be used in the construction of any building.

**Allowable  
Unit  
Stresses**

**Sec. 2702.** All parts of the structure shall be so proportioned that the sum of the maximum static stresses in pounds per square inch shall not exceed those specified in this Section.

**(a) Tension:**

Rolled Steel, on net section . . . . .	18,000
Cast Steel, on net section . . . . .	16,000
Cast Iron, on net section . . . . .	(Not allowed)

**(b) Compression, on short lengths or where lateral deflection is prevented:**

Rolled Steel . . . . .	18,000
Cast Steel . . . . .	16,000
Cast Iron . . . . .	10,000

On gross section of structural steel columns:

$$P = \frac{18,000}{1 + \frac{l^2}{18,000r^2}}$$

with a maximum of .....15,000

For main compression members, the ratio  $l/r$  shall not exceed one hundred and twenty (120) and for bracing, struts and similar members two hundred (200).

On gross section of steel pipe columns, with square or fixed ends;

$$P = 11,000 - 35 l/r$$

with a minimum gross diameter of five (5) inches.

On cast iron columns, with square or fixed ends;

$$P = 9,000 - 40 l/r$$

with a minimum gross diameter of six (6) inches and with the ratio  $l/r$  never in excess of seventy (70).

In the foregoing formulae  $P$  equals the maximum unit working stress in pounds per square inch;  $l$  equals the unsupported length of the column or compression member in inches; and  $r$  equals the least radius of gyration of the column or compression member.

(c) Bending. On extreme fibers of rolled shapes, and built-up sections, net section, if lateral deflection is prevented, 18,000. When the unsupported length  $L$  exceeds fifteen (15) times  $b$ , the width of the compression flange, the stress in pounds per square inch in the latter shall not exceed  $F$  in the following formula:

$$F = \frac{20,000}{1 + \frac{L^2}{2,000b^2}}$$

The laterally unsupported length of beams and girders shall in no case exceed forty (40) times  $b$  the width of the compression flange.

Girders, beams, lintels and similar members may be laterally braced by joists, tie rods or similar members anchored thereto so as to laterally stay such members in both directions. Two or more cast iron or steel separators rigidly joining such members together shall be considered as lateral support if the length of flanges between separators does not exceed  $40b$ .

On extreme fibers of pins, when the forces are assumed as acting at the center of gravity of the pieces .....27,000

- (d) Shearing. On pins .....13,500  
 On power-driven rivets .....13,500  
 On turned bolts in reamed holes with a  
 clearance of not more than one-fiftieth  
 (1/50) of an inch .....13,500  
 On hand-driven rivets .....10,000  
 On unfinished bolts .....10,000

On the gross area of the webs of beams and girders, where  $h$ , the height between flanges in inches, is not more than sixty (60) times  $t$ , the thickness of the web in inches . . . . . 12,000

On the gross area of the webs of beams and girders if the web is not stiffened where  $h$ , the height between flanges in inches, is more than sixty (60) times  $t$ , the thickness of the web, the maximum shear per square inch,  $S/A$  shall not exceed

$$1 + \frac{\frac{18,000}{h^2}}{7,200t^2}$$

in which  $S$  is the total shear, and  $A$  is gross area of web in square inches.

	Double Shear	Single Shear
(e) Bearing.		
On pins . . . . .	30,000	24,000
On power-driven rivets . . . . .	30,000	24,000
On turned bolts in reamed holes . . . . .	30,000	24,000
On hand-driven rivets . . . . .	20,000	16,000
On unfinished bolts . . . . .	20,000	16,000
On ends of web stiffeners . . . . .	See Section 2704 (e)	

(f) Combined Stresses: For combined stresses due to wind and other loads, the permissible working stress may be increased thirty-three and one-third ( $33\frac{1}{3}$ ) per cent, provided the section thus found is not less than that required by the dead and live loads alone.

Members subject to both direct and bending stresses shall be so proportioned that the greatest combined stresses shall not exceed the allowed limits.

All members and their connections which are subject to stresses of both tension and compression due to the action of live load shall be designed to sustain the stress giving the largest section, with fifty (50) per cent of the smaller stress added to it. If the reversal of stress is due to the action of wind, the member shall be designed for the stress giving the largest section and the connections proportioned for the largest stress.

(g) Members Carrying Wind Only. For members carrying wind stresses only, the permissible working stresses may be increased thirty-three and one-third ( $33\frac{1}{3}$ ) per cent.

(h) The load in pounds per linear inch on expansion rollers shall not exceed six hundred (600) times the diameter of the roller in inches.

## Eccentric Loads

**Sec. 2703.** (a) Every member and combination of members shall be designed to provide for any stress due to an eccentric load or force, whenever the increase in stress due to eccentric load or force exceeds ten (10) per cent of the stress due to a direct load or force on the member or members; but a member framed directly to a central web of another member shall not be considered an eccentric load or force in case the resultant of the load or force acts parallel with the said central web.

(b) Where a structural member is directly connected or framed to the flange of another member by means of a web connection, the lever arm shall be taken as the distance in the direction of bending from the neutral axis to the flange connection plus one-half ( $1/2$ ) inch; and in all other cases of an eccentric load or force, the lever arm shall be taken as the distance in the direction of bending from the neutral axis to the center line or center of bearing of the load or force.

(c) Where an eccentric load or force acts parallel with the axis of a compression member, the stresses due to the eccentric action may be provided for by adding to any direct load or force on the compression member an amount equal to  $M.K.$  as given in the following formula, and by then designing the compression member so that the maximum unit stress therein will not exceed that specified in Section 2702.

$M.K.$  equals  $A(Px/S)$ ;

in which formula  $M.K.$  equals an equivalent concentric load or force for any given eccentric load or force;  $A$  equals the cross sectional area of the compression member;  $P$  equals the amount of the eccentric load or force in pounds;  $x$  equals the distance from the neutral axis of the compression member to the extreme fiber thereof in the direction of bending; and  $S$  equals the section modulus of the compression member in the direction of the bending.

**Sec. 2704.** (a) Rolled beams shall be proportioned by the moment of inertia of their net section. Plate girders with webs fully spliced for tension and compression shall be so proportioned that the unit stress on the net section does not exceed the stresses specified in Section 2702 as determined by the moment of inertia of the net section.

## Beams and Girders

When two (2) or more rolled beams or channels are used to form a girder, they shall be so connected to each other as to properly distribute the loads to be carried.

(b) Built-up Girders. Plate, box and similar structural steel girders shall be proportioned by the moment of inertia of their net sections, or shall be proportioned by assuming that one-eighth ( $1/8$ ) of the gross area of the web or webs act as a part of the flanges thereof, in the event that every joint in the web is spliced so as to transmit the stress therein.

(c) Plate girder webs shall have a thickness of not less than one hundred-sixtieth ( $1/160$ ) of the unsupported distance between the flanges.

(d) Web splices shall consist of a plate on each side of the web capable of transmitting the full stress through the splice rivets.

(e) Stiffeners shall be provided on both sides of the webs of built-up girders over bearings and at points of concentrated loading. Intermediate stiffeners shall be provided on both sides of the webs wherever the thickness of the web is less than one-sixtieth ( $1/60$ ) of the unsupported distance between flanges and shall not be spaced farther apart in inches than the value of  $S$  in the following formula; and shall not exceed six (6) feet in any case:

$$S = 85t \sqrt{\frac{18,000A}{V} - 1}$$

in which formula  $A$  equals the gross area of the web in inches;  $V$  equals the total vertical shear on the web;  $t$  equals the thickness of the web in inches;

and  $S$  equals the clear distance between stiffeners in inches; provided, however, that stiffeners need not be provided on both sides of webs in case other adequate provision is made against buckling, torsion and for the transmission of all stresses.

Stiffeners over bearings and at points of concentrated loading shall not be crimped but shall be milled and fitted for bearing against the flange angles nearest the bearing load and shall be designed to distribute the force from the reactions and concentrated loads into the web. The bearing area of the ends of stiffeners shall be taken as the outstanding portion of the leg of the stiffener, excluding any chamfered portion thereof over the fillets of flange angles, and the bearing value of such portion may be taken at not to exceed twenty-four thousand (24,000) pounds per square inch; provided, however, that where fillers are provided between stiffeners and the web, equal in thickness to the radius of the fillet plus the thickness of the flange angle, the full area of the end of the stiffener may be used, but the bearing value shall not be taken at more than eighteen thousand (18,000) pounds per square inch.

Intermediate stiffeners need not bear against flange angles, and when girders are completely encased in concrete such stiffeners may be cut off at the edge of the fillet of the flange angle.

(f) Crane runway girders and the supporting framework shall be proportioned to resist a horizontal force equal to twenty (20) per cent of the maximum wheel loads.

(g) Rivets connecting the flanges to the web at points of direct load on the flange between stiffeners shall be proportioned to carry the resultant of the longitudinal and transverse shears.

(h) The flange plates of all girders, unless stiffened, shall be limited in width so as not to extend beyond the outer line of rivets connecting them to the flange angles more than six (6) inches or twenty (20) times the thickness of the thinnest outside plate connected.

(i) Beams, channels, girders and other members acting as skewbacks for floor arches shall be of ample strength and rigidity to withstand the lateral thrusts in addition to all other loads they may sustain.

**Thickness  
of Materials**

**Sec. 2705.** The minimum thickness of metal in structural steel shapes shall be one-fourth ( $\frac{1}{4}$ ) inch at every point and shall not be less than one-half ( $\frac{1}{2}$ ) inch at every point for any cast iron or cast steel member except as follows:

Exceptions: (1) The webs of channels and I-beams, the edges of rolled steel sections, steel joists, signs, skylight bars, non-bearing walls and partitions, suspended ceilings, cornice brackets, steel studs, and similar steel shapes shall not be limited by the above thickness requirements.

**Compression  
Splices**

**Sec. 2706.** The ends and abutting joints of all compression members shall be fully spliced, or where laterally supported and where no reversal of stresses is possible, may be faced to a plain surface parallel to the surfaces against which they bear and normal to the line of stress, and be spliced sufficiently to hold the connected members accurately and firmly in place.

**Net Sections**

**Sec. 2707.** In calculating tension members, the net section shall be used, and in deducting rivet holes they shall be assumed to be at least one-eighth ( $\frac{1}{8}$ ) of an inch greater in diameter than the nominal diameter of the rivets.

Pin-connected tension members shall have the section through the pin hole at least twenty-five (25) per cent in excess of the net section of the member, and a net section back of the pin hole equal to at least seventy-five (75) per cent of that required through the pin hole.

**Sec. 2708.** Connections carrying calculated stresses, except for lacing, sag bars or angles, hand rails, or beam connections, shall not have less than two (2) rivets; or for field connections not less than three (3) rivets.

## Connections

Members meeting at a joint shall have their lines of center of gravity meet at a point if practicable; if not, provision shall be made for any eccentricity.

The rivets at the ends of any member transmitting the stresses into that member should have their centers of gravity in the line of the center of gravity of the member; if not, provision shall be made for the effect of the resulting eccentricity. Pins may be so placed as to counteract the effect of bending due to dead load.

When a beam or girder is connected to another member in such a manner that such beam or girder acts as a continuous or fixed end beam, proper provision shall be made for the bending moments at such a connection.

Where stress is transmitted from one piece to another, through a loose filler, the number of rivets shall be properly increased; tight-fitting fillers shall be preferred.

All joints in riveted work, whether in tension or compression, shall be so spliced as to properly transmit all stresses, except as provided in Section 2706.

The minimum distance between center of the rivets and edge of plates or angles shall be one and one-half ( $1\frac{1}{2}$ ) times the diameter of rivet.

The maximum pitch of the line of stress for members composed of plates and shapes shall be twelve (12) inches or twenty (20) times the thickness of the thinnest outside plate, and for angles in built-up sections with two (2) gauge lines, with rivets staggered, the maximum pitch in each line shall be twice as great as given above.

**Sec. 2709.** In proportioning rivets, the nominal diameter of the rivet shall be used.

## Rivets and Bolts

Rivets carrying calculated stresses, and whose grip exceeds five (5) diameters, shall have their number increased one (1) per cent for each additional one-tenth ( $\frac{1}{10}$ ) inch in the rivet grip. Special care shall be used in heating and driving such rivets.

Rivets shall be used for the connections of main members carrying live loads which produce impact, and for connections subject to reversal of stresses.

Finished bolts in reamed holes may be used in shop or field work where it is impracticable to obtain satisfactory power-driven rivets. The finished shank shall be long enough to provide full bearing, and washers used under the nuts to give full grip when turned tight.

Unfinished bolts may be used in shop or field work for connections in small structures used for shelters, and for secondary members of all

structures such as purlins, girts, door and window framing, alignment bracing and secondary beams in floor.

**Welded  
Connections**

**Sec. 2710.** (a) Electric arc welding may be used (in place of riveting or bolting) for connecting structural steel or wrought iron parts or members to one another, but in no case shall the stresses in such joints exceed the allowable working unit stresses given in the following table:

**Allowable Unit Working Stresses for Static Loads**

Tension in weld metal (butt welds) . . . . .	14,000 lbs. per sq. in.
Shear in weld metal (fillet welds) . . . . .	9,000 lbs. per sq. in.
Compression in weld metal . . . . .	18,000 lbs. per sq. in.

(b) The same proportional increase in the above working stresses shall be allowed for the various given conditions as specified in parts (f) and (g) in Section 2702.

(c) The electrode wire shall conform to the American Welding Society Specifications E No. 1-A or E No. 1-B as published December, 1921, in the American Welding Society Bulletin No. 2.

All portions of the members at the point of welding shall be free from rust, paint and other foreign matter by brushing the surfaces with an iron brush, by chipping or by hammering.

(d) The Building Inspector shall require the welding operator to furnish evidence of his experience and competence in structural arc welding and may require the welder to make sample butt welds. Such sample welds must show an average tensile strength of forty-five thousand pounds (45,000) pounds per square inch with no one sample developing a tensile strength of less than forty thousand (40,000) pounds per square inch.

(e) Where electric spot or resistance welding is used the portion of the members to be welded shall be thoroughly cleaned of rust, scale or other foreign matter by pickling in a suitable acid before welding.

**Construction  
Details**

**Sec. 2711.** (a) Trusses preferably shall be riveted structures and only when there are good reasons to justify, such as where riveted field connections become unwieldy, may they be designed as pin-connected structures.

(b) All joints in riveted work, whether in tension or compression, shall be spliced as to properly transmit the stresses.

(c) Bracing shall be sufficient to safely withstand wind and other lateral forces when the building is in the process of erection as well as after completion.

(d) When two or more plates are in contact, they shall be stitch riveted with rivets not more than twelve (12) inches apart in either direction.

(e) The ends of beams, channels, girders and trusses that bear on masonry shall be so framed that the allowable stresses for masonry shall not be exceeded, and anchors of ample size and strength shall be provided thoroughly embedded in the masonry construction.

(f) The ends of all beams, channels, girders, girts, purlins and similar members, that meet on a beam, girder, truss, column or pier shall be connected to each other by a strap or through the carrying members with

not less than two (2) bolts or rivets each not less than five-eighths ( $\frac{5}{8}$ ) of an inch in diameter in the end of each connecting member.

(g) Tie rods shall be proportioned to resist their respective stresses, and holes for them shall be placed as near the spring of the arches as practicable.

**Sec. 2712** (a) Compression members of two or more pieces not connected by web or cover plates shall have their open sides provided with lattice bars or tie plates, and have tie plates as near each end as practicable, and at intermediate points where the lattice is interrupted. In main members the end tie plates shall have a length not less than the distance between the lines of rivets connecting them to the flanges, and intermediate ones not less than half this distance, and their thickness shall not be less than one-fiftieth ( $\frac{1}{50}$ ) of the same distance and the rivet pitch shall not be more than four (4) diameters. The latticing of compression members shall be proportioned to resist a shearing stress at least equal to two (2) per cent of the direct stress in the member.

**Lattice**

(b) The minimum thickness for lattice bars shall be for single lattice one-fortieth ( $\frac{1}{40}$ ) and for double lattice one-sixtieth ( $\frac{1}{60}$ ) of the distance between end rivets, and not less than one-fourth ( $\frac{1}{4}$ ) inch in thickness.

(c) The inclination of all lattice bars to the axis of the member shall not be less than forty-five (45) degrees and when the distance between the rivet lines in the flanges is more than fifteen (15) inches the lattice shall be doubled.

(d) Lattice bars shall be so spaced that the ratio  $l/r$  of the flange included between their connections shall not be over three-fourths ( $\frac{3}{4}$ ) of that of the member as a whole, where  $l$  and  $r$  are as defined in Section 2702 (b).

**Sec. 2713.** (a) Pins shall be long enough to insure a full bearing of all parts connected upon the turned-down body of the pin.

**Pins and  
Pin Holes**

(b) Members packed on pins shall be held against lateral movement.

(c) Pin holes shall be reinforced by plates wherever necessary to give proper bearing. At least one plate shall be as wide as the projecting flanges will allow. Where angles are used this plate shall contain sufficient rivets to distribute their portion of the pin pressure to the full cross section of the member.

**Sec. 2714.** (a) Steel joists shall be considered as secondary members of the structural steel frame. They shall be designed to carry all dead, live and other loads to which they may be subjected during the erection and after the completion of the structure. Such secondary members shall not be considered as affecting the vertical rigidity of the framework but they shall be designed and considered as carrying horizontal forces to such parts of the frame as are designed to carry these horizontal forces to the foundation.

**Steel Joists**

(b) Steel joists may be rolled structural steel sections, sections built up of rolled structural sections, or shapes made from strip or sheet steel securely spot-welded together so as to form a cohesive structural unit, all of which shall have the general shape or contour of an I-Beam; or such steel joist may be of a determinate truss design built up of rolled structural steel



sections effectively electrically are welded together as specified in part (f) of this Section.

(c) Stresses in steel joists shall not exceed those specified in Section 2702 and no joist under its calculated load shall have a deflection exceeding one three-hundred-sixtieth ( $1/360$ ) of the span. Bridging shall be installed sufficient to laterally stay the joists and to transmit any horizontal forces in a direction perpendicular to the direction of the joists through the floor panels and into the main structural frame. The actual spacing of the joists center to center shall be determined by their capacity to sustain the loads which they carry and the allowable load carrying capacity of the floor structure between the members.

(d) When used in buildings of Type I Construction, steel joists shall be connected to the supporting beams and/or girders by electric arc welding, riveting, bolting or rigidly connecting. Electric arc welds shall be made on both sides of each bearing, shall be not less than one (1) inch in length measured from the starting end to the center of the finishing crater, and shall have a minimum bead of one-fourth ( $1/4$ ) inch. Riveting and bolting shall comply with the requirements of Section 2709. When steel joists are supported on masonry the end bearing shall be not less than four (4) inches in length and the ends of such joists shall be provided with approved joist anchors thoroughly embedded in the supporting masonry, placed at not to exceed six (6) feet o.c. Bearing plates securely welded, bolted or riveted to the joists shall be provided when required by the design of the joist.

(e) Strip or sheet steel used to produce strip steel joists shall in no case be less than seventy-two thousandths (0.072) of an inch in thickness. The flange width of such joists shall not exceed one-half ( $1/2$ ) their depth.

(f) Trussed steel joists shall be so constructed that the lines of force of all connected members shall intersect at a point or proper allowance shall be made in the design for any resulting stress.

The joints of all trussed steel joists shall be made by connecting the members directly to one another by electric arc welds or by rivets of sufficient capacity to develop the ultimate strength of the smallest connected member. When welds are used, each connection of member to member shall be made with not less than two (2) welds, and each weld shall be not less in length measured from starting end to the center of the finishing crater than twice the diameter of the smallest member connected, nor less in cross sectional area than one-fourth ( $1/4$ ) of the cross sectional area of the smallest member connected. Welds shall be located symmetrically on both sides of all connected members so as to eliminate eccentricity at joints. When sections other than round bars are used, the length and cross sectional area of the welds shall be the same as those required for round bars of equivalent area.

(g) Whenever deemed necessary by the Building Inspector any welded connections or welded joints shall be tested to not less than twice the designed load by the manufacturer or user and such load shall be sustained without any signs of failure. Should any signs of failure develop the joist or joists shall be rejected and removed immediately from the premises.

**Sec. 2715.** Proper provision shall be made for expansion and contraction.

**Expansion**

**Sec. 2716. (a)** All workmanship shall be equal to the best practice in modern structural shops.

**Workmanship**

(b) Drifting to enlarge unfair holes shall not be permitted.

(c) The several pieces forming built-up sections shall be straight and fit close together; and finished members shall be free from twists, bends or open joints.

(d) Rolled sections shall not be heated in any manner which will impair their strength or quality.

(e) All steel castings shall be properly annealed.

(f) Material may be punched one-sixteenth ( $\frac{1}{16}$ ) inch larger than the nominal diameter of the rivets, whenever the thickness of the metal is equal to or less than the diameter of the rivets, plus one-eighth ( $\frac{1}{8}$ ) inch. When the metal is thicker than the diameter of the rivet, plus one-eighth ( $\frac{1}{8}$ ) inch, the holes shall be drilled, or sub-punched and reamed.

(g) Rivets are to be driven hot, and wherever practicable, by power. Rivet heads shall be of hemispherical shape and uniform in size throughout the work for the same size rivet, full, neatly finished, and concentric with the holes. Rivets, after driving, shall be tight, completely filling the holes, and with heads in full contact with the surface.

(h) Compression joints depending upon contact bearing shall have the bearing surfaces truly faced after the members are riveted. All other joints shall be cut or dressed true and straight, especially where exposed to view.

(i) The use of a burning torch is permissible if the burned metal is not carrying stresses during the burning. Stresses shall not be transmitted into the metal through a burned surface.

**Sec. 2717. (a)** Parts not in contact, but inaccessible after assembling, shall be properly protected by paint.

**Painting**

(b) All steel work, except where entirely encased in concrete, shall be thoroughly cleaned and given one coat of acceptable metal protection well worked into the joints and open spaces.

(c) Machine finished surfaces shall be protected against corrosion.

(d) Cast iron columns shall not be painted until after acceptance by the Building Inspector.

**Sec. 2718. (a)** The frame of all steel skeleton buildings shall be carried up true and plumb, and temporary bracing shall be introduced wherever necessary to take care of all loads to which the structure may be subjected, including erection equipment, and the operation of same. Such bracing shall be left in place as long as required for safety or deemed necessary by the Building Inspector.

**Erection**

(b) As erection progresses the work shall be securely bolted up to take care of all dead load, wind and erection stresses.

(c) Wherever piles of material, erection equipment, or other loads are carried during erection, proper provision shall be made to take care of the resulting stresses.

(d) No riveting or welding shall be done until the structure has been properly aligned.

(e) Rivets driven in the field shall be heated and driven with the same care as those driven in the shop.

(f) In the setting or erecting of steel work the individual pieces shall be considered plumb or level when the error does not exceed 1 to 500. For exterior columns and columns adjacent to elevator shafts of multiple story buildings the error shall not exceed 1 to 1000 of the total height of the column.

**PART VII****DETAILED REGULATIONS****CHAPTER 28 — EXCAVATIONS, FOOTINGS AND FOUNDATIONS**

**Sec. 2801.** All excavations for buildings and excavations accessory thereto shall be protected and guarded against danger to life and property. All permanent excavations shall have retaining walls of masonry or reinforced concrete of sufficient strength to retain the embankment together with any surcharged loads. No excavation for any purpose shall extend within one (1) foot of the angle of repose or natural slope of the soil under any footing or foundation, unless such footing or foundation is first properly underpinned or protected against settlement.

**Excavations**

Any person causing an excavation to be made on his own property, to a depth of twelve (12) feet, or less, below the grade, shall protect the excavation so that the soil of adjoining property will not cave in or settle, but shall not be liable for the expense of underpinning or extending the foundation of buildings on adjoining properties where his excavation is not in excess of twelve (12) feet in depth. Before commencing the excavation the owner shall notify in writing the owners of adjoining buildings not less than ten (10) days before such excavation is to be made that the excavation is to be made and that the adjoining buildings should be protected. The owners of the adjoining properties shall be given access to the excavation for the purpose of protecting such adjoining buildings.

Any person causing an excavation to be made exceeding twelve (12) feet in depth below the grade, shall protect the excavation so that the adjoining soil will not cave in or settle, and shall extend the foundation of any adjoining buildings below the depth of twelve (12) feet below grade at his own expense. The owner of the adjoining buildings shall extend the foundations of his building to a depth of twelve (12) feet below grade at his own expense as provided in the preceding paragraph.

**Sec. 2802.** Footings and foundations, unless specifically provided, shall be constructed of masonry or reinforced concrete and shall in all cases extend below the frost line. Masonry units used in foundation walls and footings shall be laid up in Portland cement mortar. The base areas of all footings and foundations shall be proportioned as specified in Section 2306.

**Footings  
and  
Foundations**

Footings shall be so designed that the allowable bearing capacity of the soil in tons per square foot as given below shall not be exceeded unless the particular soil on which the building is to be placed shows a greater bearing capacity than that specified in this Section.

Rock . . . . . Not more than twenty per cent (20%)  
of the ultimate crushing strength of  
such rock.

Gravel or coarse sand, well cemented . . . . .	6 tons
Dry, hard clay or coarse firm sand (hardpan) . . . . .	4 tons
Moderately dry clay or moderately dry sand and clay . . . . .	3 tons
Ordinary clay and sand . . . . .	2 tons
Soft clay, sandy loam or silt . . . . .	1 ton
Adobe . . . . .	1/2 ton

Where the bearing capacity of the soil is not definitely known or is in question, the Building Inspector may require load tests or other adequate proof as to the permissible safe bearing capacity at that particular location. To determine the safe bearing capacity of soil it shall be tested by loading an area not less than two (2) square feet to not less than twice the maximum bearing capacity desired for use. Such double load shall be sustained by the soil until no additional settlement takes place for a period of not less than forty-eight (48) hours in order that such desired bearing capacity may be used. Examination of sub-soil conditions may be required when deemed necessary.

Foundations shall be built upon natural solid ground where possible. Loam or soil containing organic matter shall not be used to support buildings exceeding one story in height. Where solid natural ground does not occur at the foundation depth, such foundations shall be extended down to natural solid ground or piles shall be used, unless there is a practically level fill of good ground which has been in place a sufficient length of time to settle properly, when such fill may be used.

## Piles

**Sec. 2803.** (a) General requirements. All piles used to support any building or part thereof shall be driven to a reasonably solid bearing in such a manner as not to impair their strength. No pile or group of piles shall be loaded eccentrically.

(b) Wood piles. Wood piles shall be of oak, fir, cedar or other approved wood which is sound and reasonably straight. The diameter of wood piles at the point shall be not less than six (6) inches and at the butt shall be not less than ten (10) inches for piles twenty-five (25) feet or less in length and shall be not less than twelve (12) inches at the butt for piles more than twenty-five (25) feet in length. All wood piles shall be cut off level and below low water level or below permanent ground water level and any capping or ranging timbers shall be so placed that the tops of such timbers shall be below the level required for pile cut-off. Wood piles shall be spaced apart not less than twice the average butt diameter.

The allowable load on a wood pile shall in no case exceed twenty-five (25) tons and shall in no case exceed the values determined by the following formulas:

For piles driven by drop hammer

$$L = 2 wh / s + 1 \dots\dots\dots(1)$$

For piles driven by steam hammer

$$L = 2 wh / s + 0.1 \dots\dots\dots(2)$$

Where L equals the safe load in tons, w equals the weight of the hammer in tons, h equals the height of fall or stroke of hammer in feet, s equals the average penetration in inches under the last five (5) blows.

(c) Concrete piles. Concrete piles shall be of material complying with the requirements for Portland cement, fine aggregate, coarse aggregate and reinforcement as specified in Chapter 26 and steel as specified in Chapter 27. The maximum allowable working stress on any concrete pile shall not exceed twenty (20) per cent of the ultimate compressive strength of the concrete used in the piles, determined by tests as specified in Chapter 26. The maximum allowable load on any pile shall not exceed such working stress multiplied by the average cross sectional area of the pile.

Exception: When such pile is cast in a tight steel tube not less than five-sixteenths ( $\frac{5}{16}$ ) inch thick, the allowable working stress shall be not more than twenty-five (25) per cent of the ultimate compressive strength plus an allowable stress of not to exceed six thousand (6000) pounds per square inch for the steel tube, not including in such latter computation the outer one-sixteenth ( $\frac{1}{16}$ ) inch of the steel shell.

Concrete piles cast in place shall be made in such a manner as to insure the exclusion of any foreign matter and to secure a full sized shaft. The length of such piles shall be limited to not more than thirty (30) times the average diameter, except that when cast in steel tubes with a thickness of not less than five-sixteenths ( $\frac{5}{16}$ ) inch the length of such piles shall be not greater than forty (40) times the average diameter. The diameter of concrete-filled steel tubes shall be not less than twelve (12) inches and such piles shall be driven to a full bearing on rock. The diameter of other piles cast in place shall be not less than eight (8) inches at the point and shall have an average diameter of not less than eleven (11) inches.

Pre-cast concrete piles shall be sufficiently cured to attain the ultimate strength upon which their use is based, before driving. Such piles shall be reinforced and so handled as not to be fractured in any manner which will affect their durability or strength. Pre-cast concrete piles shall have a diameter at the point of not less than eight (8) inches, and an average diameter of not less than twelve (12) inches. The length of such piles when driven to rock shall be limited to twenty (20) times the average diameter and shall not exceed forty (40) times the average diameter in any other case.

The allowable load on a concrete pile when driven by a drop hammer or by a steam hammer shall not exceed the values determined by Formulas No. 1 and No. 2 respectively of this Section.

(d) The safe bearing power of any pile shall be determined by a load test whenever deemed necessary and ordered by the Building Inspector. The test pile or piles shall be loaded to twice the design load and the resultant settlement shall be measured until during a forty-eight (48) hour period no appreciable additional settlement takes place. The total settlement in inches shall not exceed one one-hundredth ( $\frac{1}{100}$ ) times the test load in tons where the foundations carry a structure continuous over two or more spans nor twice this amount where the foundation carries non-continuous spans.

## CHAPTER 29 — WALLS AND PARTITIONS

## ARTICLE I

## Solid Masonry Walls

**General  
Provisions:  
Solid  
Masonry  
Walls**

**Sec. 2901.** Solid masonry walls shall be supported at right angles to the wall face at intervals not exceeding sixteen (16) times the wall thickness in the top story or eighteen (18) times the wall thickness elsewhere. Such lateral support may be obtained by masonry cross walls, piers or buttresses when the limiting distance is measured horizontally or by floors or roof when the limiting distance is measured vertically. Bonding and anchoring of horizontal and vertical framing members to the wall shall be provided sufficient to resist the assumed wind force acting in an outward direction. Floors and roofs shall be so constructed and anchored to such walls as to form a continuous and sufficient anchorage across the building from wall to wall. Anchoring of wood framing to masonry walls shall be as specified in Sections 2506, 2507 and 2508. Piers or buttresses relied upon for lateral support shall have sufficient strength and stability to transfer the wind force acting in either direction to the ground. When walls are dependent upon floors for their lateral support provision shall be made in the building to transfer the lateral forces resisted by all floors to the ground.

Corbels may be built into masonry walls to furnish bearing for joists or other structural parts, but such corbels shall not exceed one-fourth ( $\frac{1}{4}$ ) the total thickness of the wall and the projection for each course in such corbel shall not exceed one-half ( $\frac{1}{2}$ ) inch. Corbeling of walls eight (8) inches or less in thickness shall not be allowed.

**Working  
Stresses**

**Sec. 2902.** The maximum allowable compressive stresses in solid masonry due to combined live, dead and other loads shall not exceed those specified in Sections 2410 and 2411.

**Thickness  
of Exterior  
Walls Other  
Than  
Skeleton  
Construction**

**Sec. 2903.** (a) The thickness of solid masonry walls shall be sufficient at all points to keep the combined stresses due to live, dead and other loads for which the building is designed within the limits specified in Sections 2410 and 2411.

The minimum thickness of solid masonry exterior, bearing or party walls shall be not less in thickness than specified in the following table No. 1; provided, that in no case shall the uppermost thirty-five (35) feet of such walls be less than twelve (12) inches in thickness, and each successive thirty-five (35) feet or fraction thereof measured downward from the top shall be increased not less than four (4) inches in thickness.

Table No. 1

8th	.....	12						
7th	.....	12	12					
6th	.....	12	12	12				
5th	.....	16	12	12	12			
4th	.....	16	16	12	12	12		
3rd	.....	16	16	16	12	12	12	
2nd	.....	20	16	16	16	12	12	12
1st	.....	20	20	20	16	16	16	12
Basement	.....	20	20	20	20	16	16	12
Stories	.....	8	7	6	5	4	3	2

Exceptions: (1) The top story exterior bearing wall of a building not exceeding three (3) stories or forty (40) feet in height, or the wall of a one-story commercial or industrial building may be eight (8) inches; provided, that such eight (8) inch wall does not exceed twelve (12) feet unsupported height and that the roof beams or trusses are so placed or constructed as not to develop any direct thrust against the wall.

(2) Exterior walls for dwellings shall be as specified in part (c) of this Section.

(3) Solid masonry exterior bearing or party walls constructed as specified in part (d) of this Section may be of lesser thickness.

(b) Non-bearing walls of solid masonry shall be not less in thickness than specified in the following Table No. 2; provided, that in no case shall the uppermost fifteen (15) feet of such wall be less than eight (8) inches thick and that each successive fifty (50) feet or fraction thereof measured downward from the top shall be increased not less than four (4) inches in thickness.

Table No. 2

8th	8						
7th	12	8					
6th	12	12	8				
5th	12	12	12	8			
4th	12	12	12	12	8		
3rd	16	12	12	12	12	8	
2nd	16	16	12	12	12	12	8
1st	16	16	16	16	12	12	8
Basement	20	16	16	16	16	12	12
Stories	8	7	6	5	4	3	2

Exceptions: (1) Solid masonry non-bearing walls for private dwellings not over three (3) stories high shall be as specified in part (c) of this Section.

(c) Solid masonry walls, either bearing or non-bearing, for private dwellings not over three (3) stories in height shall not be less in thickness than specified in Table No. 3.

Table No. 3

3rd	8		
2nd	8	8	
1st	12	8	8
Basement	12	12	8
Stories	3	2	1

(d) Where solid masonry bearing or non-bearing walls other than fire walls or fire division walls are strengthened laterally by masonry buttresses or cross walls the wall thicknesses specified in parts (a), (b) and (c) of this Section may be reduced between buttresses by one-half ( $\frac{1}{2}$ ) the thickness added at the buttress, except that no part of such buttress wall shall be less than eight (8) inches thick. Buttresses shall be not less than one-eighth ( $\frac{1}{8}$ ) the clear distance between them in width and their clear distance apart shall not exceed twenty-four (24) times the reduced wall thickness. Principal girders and trusses shall rest on the buttresses.



In one-story buildings having walls not over sixteen (16) feet high to the under side of girders or trusses and pilastered as above provided for an eight (8) inch wall between pilasters, such walls may be considered as bearing walls for roof loads and parapet walls only.

**Bonds**

**Sec. 2904.** In all solid unit masonry walls at least every sixth course on both sides of the wall shall be a header course or there shall be at least one full header in every seventy-two (72) square inches of each wall surface. In walls more than twelve (12) inches thick the inner joints of header courses shall be covered with another header course which shall break joints with the course below.

Where running bond is used, every sixth course on each face shall be bonded into the backing by cutting the face brick course and using diagonal headers behind it or by using a split brick.

**Piers**

**Sec. 2905.** The unsupported height of isolated piers shall not exceed ten (10) times their least dimension. Piers of solid unit masonry shall be laid up in cement mortar.

Walls in which the openings are of such an extent as to leave relatively narrow sections exceeding ten (10) feet in height shall have such narrow sections computed and constructed as for isolated piers.

**Chases and  
Recesses**

**Sec. 2906.** There shall be no chases in eight (8) inch walls or within the required area of any pier, and no chase in any wall or pier shall be deeper than one-third ( $\frac{1}{3}$ ) the wall thickness. No horizontal chase shall exceed four (4) feet in length nor shall the horizontal projection of any diagonal chase exceed four (4) feet. No vertical chase shall be closer than two (2) feet to any pilaster, cross wall, end wall or other stiffener.

Recesses for stairways or elevators may be made in walls, but in no case shall the walls at such points be less than the required thickness of walls of the fourth story above the ground floor unless reinforced by additional piers, by steel or reinforced concrete girders or steel or reinforced concrete columns and girders, securely anchored to the walls on each side of such recesses. Recesses for alcoves and similar purposes shall have not less than eight (8) inches of material at the back. Such recesses shall be not more than eight (8) feet in width and shall be arched over or spanned with lintels.

The aggregate area of recesses and chases in the wall of any one story shall not exceed one-fourth ( $\frac{1}{4}$ ) the whole area of the face of the wall in that story.

No chases or recesses shall be permitted in fire or fire division walls that will reduce the thickness below the minimum specified in this Code.

Openings for doors and windows shall have well buttressed arches or lintels of masonry, or of metal with bearing at each end of not less than four (4) inches on the wall. On the inside of openings less than four (4) feet wide, in which the thickness of arches and lintels is less than that of the wall supported, timber may be used, which will rest at each end not more than two (2) inches on the wall and be chamfered or cut to serve as arch centers.

The maximum percentage of openings in the horizontal cross section of any wall shall not exceed fifty (50) per cent unless the wall is increased four (4) inches in thickness or such portions of the wall between openings shall be as required for piers in Section 2905.

## ARTICLE II

### Walls of Hollow Tile, Concrete Block or Tile, Hollow Walls of Brick and Hollow Monolithic Plain Concrete Walls

**Sec. 2907.** Walls of hollow clay tile, of concrete block or tile, hollow walls of solid masonry units and hollow monolithic plain concrete walls shall be supported at right angles to the face at intervals not exceeding fourteen (14) times the wall thickness in top stories or sixteen (16) times the wall thickness elsewhere.

The general provisions relating to solid masonry walls as specified in Section 2901 shall apply to hollow walls as included in this Section; provided, that corbeling from hollow walls shall not be permitted except when such corbels are constructed of solid masonry or reinforced concrete.

Where air spaces are built into the wall the area of such air spaces combined with the area of the cellular space in the tile used in the construction of the wall shall not exceed forty-five (45) per cent of the gross cross-sectional area of the wall.

No combination solid masonry and hollow unit wall shall be allowed less than ten (10) inches nominal in total thickness.

**Sec. 2908.** The maximum allowable compressive stresses in walls of hollow tile, concrete block or tile, hollow walls of brick or hollow monolithic plain concrete walls due to combined live, dead and other loads shall not exceed those specified in Sections 2410 and 2411.

**Sec. 2909.** Walls of hollow clay tile, grade B concrete block or tile, hollow walls of solid masonry units and hollow monolithic concrete walls shall be not less in thickness than as specified in the following Table No. 4; provided, that in no case shall the uppermost twenty-five (25) feet of such walls be less than twelve (12) inches in thickness, and each successive twenty-five (25) feet or fraction thereof measured downward from the top shall be increased not less than four (4) inches in thickness.

**General  
Provisions:  
Hollow  
Walls**

**Working  
Stresses**

**Thickness  
and Height  
of Walls  
Other Than  
Skeleton  
Construction**

Table No.4

8th .....	12							
7th .....	12	12						
6th .....	16	12	12					
5th .....	16	16	12	12				
4th .....	20	16	16	12	12			
3rd .....	20	20	16	16	12	12		
2nd .....	24	20	20	16	16	12	12	
1st .....	24	24	20	20	16	16	12	12
Basement .....	30	24	24	20	20	16	16	12
Stories .....	8	7	6	5	4	3	2	1

Walls of grade A hollow concrete block or tile (as specified in Section 2406) shall not be of less thickness than is specified for solid masonry walls in Tables No. 1, 2 and 3 of Section 2903, and such walls shall be laid in cement mortar proportioned as specified in Section 2409.

One-story private garages and one-story residences may have bearing and non-bearing walls of hollow tile, concrete block or tile or hollow monolithic plain concrete walls six (6) inches thick.

**Bond**

**Sec. 2910.** All hollow masonry units in a wall shall be solid bedded in mortar and laid with a full masonry bond.

Where two (2) or more hollow units are used to make up the thickness of a wall the inner and outer courses shall be bonded every course by lapping at least one cell completely over the cell below.

**Beam  
Supports**

**Sec. 2911.** Suitable provision shall be made in hollow walls or walls of hollow units at each line of floor joists or beams to shut off the spaces above from those below with incombustible material.

Joists, beams or other structural members shall not be seated directly on hollow walls or walls of hollow units, but shall be supported on at least three (3) courses of brick or equivalent concrete or metal plate of sufficient thickness and size to distribute the load to the webs and shells in such a manner as not to exceed the allowable unit stress.

**Piers**

**Sec. 2912.** Hollow tile or concrete block or tile shall not be used for isolated piers. Wall sections greater in height than ten (10) times their least dimension and two (2) feet or less in width shall be considered as isolated piers.

**Chases and  
Recesses**

**Sec. 2913.** Chases and recesses in walls of hollow tile, hollow concrete block or tile, or in hollow walls of brick shall not exceed in extent those permitted for solid masonry walls under the same conditions. Chases and recesses shall not be cut in walls of the above types, but may be built in. No chases or recesses shall be permitted in fire walls that will reduce the thickness below the minimum specified in this Code.

Reinforced tile lintels over openings made by filling the cells of the hollow units with cement mortar or concrete and inserting reinforcing bars may be used. Such lintels shall be computed as reinforced concrete beams on the basis of the enclosed concrete or mortar.

**ARTICLE III**

**Reinforced Concrete Walls**

**General  
Provisions:  
Reinforced  
Concrete  
Walls**

**Sec. 2914.** The general provisions of Chapter 26 of this Code shall apply to the design and construction of reinforced concrete walls provided that where any conflict may occur the provisions of this Article shall govern.

Reinforced concrete bearing walls shall have a thickness of not less than one twenty-fifth ( $1/25$ ) of the unsupported height; provided, that approved buttresses, built-in columns or piers may be used in lieu of greater thicknesses.

Reinforced concrete walls shall be supported at right angles to the wall face at intervals not exceeding twenty-two (22) times the wall thickness in the top story or twenty-five (25) times the wall thickness elsewhere. Such lateral support may be obtained by masonry or reinforced concrete cross walls, piers, buttresses or built-in columns when the limiting distance is measured horizontally or by floors or roof when the limiting distance is measured vertically. Bonding and anchoring shall be provided between the wall and the supports to resist the assumed wind force acting in an outward direction. Piers, buttresses or built-in columns relied upon for lateral support shall have sufficient strength and stability to transfer the wind force acting in either direction, to the ground. When walls are dependent upon floors for their lateral support, provision shall be made in the building to transfer the lateral forces resisted by all floors, to the ground. Anchoring of interior wood framing shall be as specified in Chapter 26.

Corbeling of reinforced concrete walls for the support of beams, girders and other members shall be fully provided for in the design of the wall at that point.

**Sec. 2915.** The maximum allowable compressive stress in reinforced concrete walls due to combined live, dead and other loads shall not exceed  $0.07 f'_c$  when the unsupported height of the wall is twenty-five (25) times the thickness, nor  $0.15 f'_c$  when the unsupported height of the wall is fifteen (15) times the thickness or less with allowable stresses proportional between those limits of height.

**Sec. 2916.** The thickness of reinforced concrete bearing walls shall be sufficient at all points to keep the combined stresses due to dead, live and/or other loads for which the building is designed, within the limits specified in Section 2915.

The minimum thickness of reinforced concrete bearing or party walls shall be not less than the thickness specified in Table No. 5.

Table No. 5

8th .....	8						
7th .....	9	8					
6th .....	10	9	8				
5th .....	11	10	9	8			
4th .....	12	11	10	9	8		
3rd .....	13	12	11	10	9	8	
2nd .....	14	13	12	11	10	9	8
1st .....	15	14	13	12	11	10	9
Basement .....	16	15	14	13	12	11	10
Stories .....	8	7	6	5	4	3	2

Such reinforced concrete walls shall have not less than one-tenth ( $1/10$ ) of one (1) per cent of reinforcement in each direction, horizontally and vertically and the steel shall be distributed equally to each face of the wall with a maximum bar spacing of twenty-four (24) inches in each face.

Non-bearing walls of reinforced concrete complying with all of the provision of this Section shall be of not less thickness than that specified in the following Table No. 6.

**Working  
Stresses**

**Thickness  
of Walls  
other than  
in Skeleton  
Construction**

Table No. 6

8th .....	6							
7th .....	7	6						
6th .....	8	7	6					
5th .....	9	8	7	6				
4th .....	10	9	8	7	6			
3rd .....	11	10	9	8	7	6		
2nd .....	12	11	10	9	8	7	6	
1st .....	13	12	11	10	9	8	7	6
Basement .....	14	13	12	11	10	9	7	7
Stories .....	8	7	6	5	4	3	2	1

All such reinforced concrete walls shall be laterally supported by a reinforced concrete or fire-proofed structural steel floor system when supported from one side only and may be supported by combustible floors when supported laterally from both sides.

**Piers**

**Sec. 2917.** The unsupported height of piers of reinforced concrete walls shall not exceed ten (10) times their least dimensions unless designed as reinforced concrete columns.

Walls in which the openings are of such an extent as to leave relatively narrow sections exceeding ten (10) times their least dimensions in height shall be considered as piers.

**Chases and Recesses**

**Sec. 2918.** Chases and recesses shall be as permitted in solid masonry walls in Section 2906.

Openings for doors and windows shall have reinforced concrete lintels designed as specified in Chapter 26, or fire-proofed steel lintels as specified in Chapter 27.

#### ARTICLE IV. Stone Walls

**Quality of Material**

**Sec. 2919.** Stone used in masonry wall construction shall be at least equal in strength to the minimum specified for plain concrete in Section 2404.

**Working Stresses**

**Sec. 2920.** The maximum allowable compressive stresses in rubble stonework due to combined live, dead and other loads shall not exceed those specified in Sections 2410 and 2411.

**Lateral Support and Thickness**

**Sec. 2921.** Rubble stone walls shall be four (4) inches thicker than is required for solid brick walls of the same respective heights, but in no part less than sixteen (16) inches.

The minimum thickness for walls or piers of ashlar masonry properly bonded shall be the same as required for solid brick walls and piers under similar conditions.

The lateral support for stone walls shall conform to the same requirements specified for solid masonry walls in Section 2901.

**Bond**

**Sec. 2922.** Bond stones extending through the wall and uniformly distributed shall be provided to the extent of not less than ten (10) per cent of the area, and there shall be at least one bond stone for every eight (8) stretchers.

**Chases and Recesses**

**Sec. 2923.** Chases and recesses in stone walls shall not exceed in extent those permitted for solid masonry walls under the same conditions.

## ARTICLE V. Veneered Walls

**Sec. 2924.** Materials used in the veneering and backing of veneered walls shall conform in all respects to the requirements prescribed for such materials in Part VI. Stone or architectural terra cotta, ashlar, or other approved masonry material used for veneering shall be not less than three (3) inches thick. In stone ashlar each stone shall have a reasonable uniform thickness, but all stones need not necessarily be the same thickness.

**Quality of  
Material**

**Sec. 2925.** The maximum allowable compressive stress on the backing of veneered walls, due to combined live and dead loads, shall not exceed those permitted for masonry of the type which forms such backing. In no case shall the veneering be considered a part of the wall in computing the strength of bearing walls, nor shall it be considered a part of the required thickness of the wall.

**Working  
Stresses**

**Sec. 2926.** When walls are veneered with brick, terra cotta, stone or concrete trim stone the veneering shall be tied into the backing either by a header for every three hundred (300) square inches of wall surface, or by substantial non-corrodable metal wall ties spaced not farther apart than one (1) foot vertically and two (2) feet horizontally. Headers shall project at least three and three-quarters ( $3\frac{3}{4}$ ) inches into the backing, and anchors shall be of substantial pattern. When veneering is used special care shall be taken to fill all joints flush with mortar around wall openings.

**Attachment  
of  
Veneering**

**Sec. 2927.** Veneer on masonry walls, other than panel or enclosure walls, shall not exceed forty (40) feet in height above foundations.

**Height of  
Veneered  
Walls**

## ARTICLE VI. Faced Walls

**Sec. 2928.** Material used in the backing and facing of faced walls shall conform in all respects to the requirements prescribed for such materials in Part VI.

**Quality of  
Material**

Materials used for facing shall be not less than three and three-fourths ( $3\frac{3}{4}$ ) inches thick, and in no case less in thickness than one-eighth ( $\frac{1}{8}$ ) the height of the unit, excepting that spandrel and other recessed panels, when approved, may be higher than eight (8) times their thickness, provided they are of the minimum thickness required in this paragraph.

**Sec. 2929.** The maximum allowable compressive stresses on faced walls due to combined live, dead and other loads shall not exceed those permitted for masonry of the type which forms the backing. Where bonded to the backing as provided in Section 2931, the full cross section of the facing may be considered in computing bearing strength.

**Working  
Stresses**

**Sec. 2930.** Faced walls shall be not less in thickness than is required for masonry walls of the type which forms the backing. Where bonded to the backing as provided in Section 2931 the facing may be considered a part of the wall thickness.

**Thickness**

**Bond**

**Sec. 2931.** Solid unit masonry facing shall be bonded to walls of solid masonry or of hollow clay tile, or of concrete block or tile with at least one (1) header course in every six (6) courses, or there shall be at least one (1) full length header in every seventy-two (72) square inches of wall surface.

Stone ashlar facing shall have at least twenty (20) per cent of the superficial area not less than three and three fourths ( $3\frac{3}{4}$ ) inches thicker than the remainder of the facing to form bond stones, which shall be uniformly distributed throughout the wall.

When some stones in every alternate course are at least seven and one-half ( $7\frac{1}{2}$ ) inches thick, and at least twenty (20) per cent of the superficial area of the wall is constituted of such bond stone uniformly distributed the ashlar facing may be counted as part of the wall thickness. Every stone not a bond stone and every projecting stone shall be securely anchored to the backing with substantial non-corrodable metal anchors three-sixteenths inch by one inch ( $\frac{3}{16}'' \times 1''$ ) into the masonry backing. There shall be at least one anchor to each stone and not less than two anchors for each stone more than two (2) feet in length or three (3) square feet in superficial area. Facing stones over twelve (12) square feet in area shall have at least one (1) anchor to each four (4) square feet of superficial face area.

**ARTICLE VII.**

**Fire Walls, Fire Division Walls and Parapet Walls**

**Fire Walls:  
Solid  
Masonry**

**Sec. 2932.** Solid masonry and reinforced concrete fire walls shall be not less in thickness than required for exterior bearing walls of corresponding height but never less than twelve (12) inches thick except that solid masonry fire walls for Group H and I buildings, shall be not less than eight (8) inches thick for the uppermost twenty-five (25) feet of height and shall be not less than twelve (12) inches thick for the remaining lower portion. No eight (8) inch fire wall shall be broken into subsequent to building, for the insertion of structural members, and a separation of not less than eight (8) inches of solid masonry shall be provided in all fire and party walls between combustible members which may enter such walls from opposite sides. Party walls which function also as fire walls shall conform to the requirements of fire walls. No chases or recesses shall be built into fire walls which will reduce the required minimum thickness.

**Hollow  
Fire  
Walls**

**Sec. 2933.** Hollow masonry fire walls shall not be permitted as fire walls in Fire Zone No. 1 unless faced on each side thereof by not less than a four (4) inch veneer of brick work well bonded into the hollow wall construction.

Fire walls of hollow clay tile, concrete block or tile shall be not less than sixteen (16) inches thick in any part, except that for residential buildings they may be not less than twelve (12) inches thick. Hollow walls of solid masonry units used as fire walls shall be not less than twelve (12) inches thick. No fire walls of the above types shall be broken into, subsequent to erection for the insertion of structural members.

When combustible or unprotected steel building members frame into the hollow part of fire walls of thickness not greater than twelve (12) inches, they shall not project more than four (4) inches into the walls and shall be so spaced that the distance between embedded ends is not less than four (4) inches. The space above, below and between such members shall be filled solidly with burnt clay materials, mortar, concrete or equivalent fire-resistive materials, to a depth of not less than four (4) inches on all sides of the members.

All open cells in tile blocks occurring at wall ends shall be filled solid with concrete or cement mortar for at least a depth of six (6) inches, or closure tile set in the opposite direction shall be used.

Party walls which function as fire walls shall conform to the requirements of fire walls.

**Sec. 2934.** Fire division walls of solid masonry shall be not less than eight (8) inches thick. Fire division walls of hollow clay tile, concrete block or tile, hollow walls of brick or of hollow monolithic concrete shall be not less than ten (10) inches thick. Fire division walls of reinforced concrete shall be not less than six (6) inches thick. The wall thicknesses specified in this Section shall be increased fifty (50) per cent when used for separating buildings of Group E occupancies and Divisions 2 and 3 of Group F occupancies.

#### **Fire Division Walls**

**Sec. 2935.** On all buildings, except on Group H and I buildings three (3) stories or less in height, all exterior, fire or party walls shall project above the roof as parapets; provided, that where such wall fronts on a street and where the roof construction is entirely of incombustible materials, such parapet wall may be omitted; and provided, further, that for buildings twenty (20) feet or less in height or where the adjoining roof slopes more than twenty (20) degrees from the horizontal such parapet walls may be omitted. All required parapet walls shall be not less than thirty (30) inches above the roof immediately adjacent thereto and when exceeding six (6) times their thickness in height shall be laterally supported.

#### **Parapet Walls**

All parapet walls shall have a coping of incombustible material. On Group H and I buildings not more than three (3) stories high, exterior and fire walls shall extend above combustible roofs to a height not less than twenty-four (24) inches above the roof where the pitch of the roof does not exceed three (3) inches in twelve (12) inches. Where the pitch of the roof exceeds three (3) inches in twelve (12) inches such walls may terminate at the upper side of the roof boards.

### **ARTICLE VIII.**

#### **Partitions**

**Sec. 2936.** All interior bearing walls, which do not extend through more than one (1) story, except fire walls, fire division walls and party walls shall be considered as bearing partitions.

#### **Bearing Partitions**



Solid masonry bearing partitions shall be not less than eight (8) inches thick and those of hollow clay tile, concrete block or tile or hollow walls of brick shall be not less in thickness than one-eighteenth ( $\frac{1}{18}$ ) of the height between floors or floor beams but never less than eight (8) inches.

**Non-bearing  
Partitions**

**Sec. 2937.** Brick non-bearing partitions shall be not less than three and three-fourths ( $3\frac{3}{4}$ ) inches thick for a height not exceeding twelve (12) feet between floors or floor beams or roofs. Non-bearing partitions of hollow clay tile, concrete block or tile, plain concrete, hollow walls of brick or of gypsum block or other similar materials shall be built solidly against the floor and ceiling construction below and above and shall not exceed the following unsupported heights:

Thickness Exclusive of Plaster (Inches)	Maximum Unsupported Height (Feet)
3	12
4	15
6	20
8	25

Solid or hollow non-bearing partitions of reinforced plaster shall have a thickness of not less than one-sixtieth ( $\frac{1}{60}$ ) of the unsupported height, but never less than one and one-half ( $1\frac{1}{2}$ ) inches for solid partitions nor have a shell thickness of less than three-fourths ( $\frac{3}{4}$ ) of an inch for hollow partitions. Such partitions shall have vertical steel or iron channels with a depth of not less than one-half ( $\frac{1}{2}$ ) the thickness of the partition, made of not less than number twenty (No. 20) U.S. Gauge metal and spaced not more than twenty-four (24) inches o. c.

Solid or hollow non-bearing partitions of reinforced gunite shall have a thickness of not less than one-seventieth ( $\frac{1}{70}$ ) of the unsupported height but never less than one and one-half ( $1\frac{1}{2}$ ) inches for solid partitions nor have a shell thickness of less than three-fourths ( $\frac{3}{4}$ ) of an inch for hollow partitions. Vertical channels shall be installed in gunite partitions as specified for plaster partitions above.

**ARTICLE IX.  
Foundation Walls**

**Foundation  
Walls**

**Sec. 2938.** Solid masonry foundation walls and those of concrete block or coursed stone shall be not less in thickness than the wall immediately above and in no case less than twelve (12) inches thick unless otherwise specified in Chapter 28, except that when the space enclosed within the foundations is not excavated they may be eight (8) inches if included within the allowable height of eight (8) inch walls and if the walls supported by such foundation are not more than eight (8) inches in thickness. When built of concrete cast in place, foundation walls shall be at least as thick as the walls supported, but in no case less than eight (8) inches. When built of

rubble stone, they shall be at least sixteen (16) inches thick. Rough or random rubble without bonding or level beds shall not be used as foundations for walls exceeding thirty-five (35) feet in height nor shall coursed bonded rubble walls be used as foundations for walls exceeding seventy-five (75) feet in height.

Foundations for walls of hollow clay tile, concrete block or tile and hollow walls of brick, shall be of the same thickness, respectively, as required in the paragraph above, and shall be built of brick, stone, concrete (plain or reinforced), hollow clay tile, concrete block or tile, or as a hollow wall of brick. Tile foundation walls shall be not less than twelve (12) inches thick.

When the stresses due to earth pressure and superimposed building load exceed the maximum working stress permitted in this Code for the materials used, and the additional stresses are not otherwise provided for, the wall thickness shall be increased to bring the stresses within the required limits.

All foundation walls shall extend below the level of frost action, and shall not be constructed of gypsum.

Materials for foundation walls shall be equal in quality in all respects to those required for exterior bearing walls, except that mortar used for exterior foundation walls below grade shall be cement mortar.

Foundations built of masonry units, whether hollow or solid, shall be sealed below any woodwork with a cement wash or equally effective seal.

## **ARTICLE X.**

### **Panel and Enclosure Walls**

**Sec. 2939.** Panel and enclosure walls in skeleton framed buildings shall be not less than eight (8) inches thick if of solid brick, hollow clay tile, concrete block or tile, plain concrete or hollow walls of brick, nor less than one-twentieth ( $1/20$ ) the distance between supporting or enclosing members. Panel and enclosure walls of reinforced concrete shall be not less than six (6) inches thick and sufficiently reinforced to resist the wind pressure specified in Section 2307 from either direction. Panel and enclosure walls of reinforced gunite shall be not less than four (4) inches thick and shall be reinforced as required for reinforced concrete walls.

Enclosure walls shall be securely fastened to the adjoining framing members.

When panel or enclosure walls are built monolithic with columns or bearing walls they may be reinforced to carry their own weight.

### **Panel and Enclosure Walls**

## **ARTICLE XI.**

### **Miscellaneous Requirements**

**Sec. 2940.** All walls shall be securely anchored and bonded at points where they intersect and where they abutt or adjoin the frame of a skeleton framed building.

When walls are not built at the same time the perpendicular joint shall be regularly toothed with not less than four (4) inch offsets and the joint shall be provided with anchors not less than two inches by three-eighths inch

### **Anchoring of Walls**

(2" × 3/8") metal with ends bent up not less than two (2) inches or with cross pins to form anchorage. Such anchors shall be not less than three (3) feet long extending eighteen (18) inches in from each side of the joint and spaced not more than three (3) feet apart in the direction of the height of the wall.

Reinforcing in concrete walls shall be extended not less than twenty-four (24) inches around all corners and wall intersections.

**Use of  
Existing  
Walls**

**Sec. 2941.** An existing masonry wall may be used in the renewal or extension of the building providing it meets the requirements of this Code, and is structurally sound or can be made so by reasonable repairs. Existing walls which are structurally sound but which are of insufficient thickness when increased in height shall be strengthened by an addition of the same material not less than eight (8) inches in thickness laid up in Portland cement mortar, or the wall may be built out with gunite to the thickness required for a new wall of that height. Foundations and lateral supports shall be provided as required for newly constructed walls under similar conditions. All additions or linings shall be thoroughly bonded into existing masonry by toothings to assure combined action of wall and lining. Such toothings shall be distributed uniformly throughout the wall and shall aggregate in vertical cross-sectional area not less than fifteen (15) per cent of the total vertical area of the wall or lining.

## CHAPTER 30

### ENCLOSURE OF VERTICAL OPENINGS

**Sec. 3001.** Vertical openings are required to be enclosed in certain buildings depending upon the occupancy of the building, height of building or the type of construction. The vertical openings required to be enclosed are specified under Occupancy in Part III, and for stairways and ramps are specifically included in Chapter 33.

**Enclosures;  
When  
Required**

**Sec. 3002.** When stairways and/or ramps are required to be enclosed such enclosures shall also include a complete passageway not less in width at any part than the required width of such stairway or ramp and such enclosure shall extend from the lowest point to the highest point required. All doors opening into such enclosures shall be of metal or shall be metal-clad doors as specified in Section 4304, and all windows shall be of wire glass and metal frames and sash; except that when such openings face directly on a street or court and are not within ten (10) feet of an adjacent lot line such protection may be omitted. All such doors shall be self-closing and be kept normally closed.

**Stairway,  
Ramp and  
Elevator  
Enclosures**

Walls and partitions enclosing stairways, ramps or elevators shall be of not less than two-hour fire-resistive construction as specified in Section 4302; except as specifically provided in Sections 1907 and 2007 where one-hour fire-resistive construction is specified. Enclosing walls of elevator shafts may consist of wire glass set in metal frames on the entrance side only. Elevator shafts extending through more than two (2) stories shall be equipped with an approved means of adequate ventilation to and through the main roof of the building.

**Sec. 3003.** All shafts, ducts, chutes and other vertical openings not covered in Section 3002 shall have enclosing walls conforming to the requirements specified under Type of Construction of the building in which they are located when they exceed nine (9) square feet in area, and all other shafts shall be lined with sheet metal having lock jointed or riveted seams and joints. Combustible material of partitions and floors through which the ducts pass shall be kept at least three (3) inches from the metal lining or be protected by not less than three-eighths ( $\frac{3}{8}$ ) of an inch of plaster or one-fourth ( $\frac{1}{4}$ ) of an inch of asbestos or plasterboard. Openings between any ducts and the floor construction through which they pass shall be filled with mortar or other incombustible material supported by wire baskets that prevent the passage of fire. All doors opening into such vertical shafts shall be of metal or shall be covered on the side by not less than one-fourth ( $\frac{1}{4}$ ) of an inch of asbestos and not less than twenty-six (26) gauge metal returned around all edges and well fastened to the door. Windows in such shafts shall be wire glass and metal frames and sash or such frame and sash may be of wood entirely clad with metal of not less than twenty-six (26) gauge.

**Other  
Vertical  
Openings**

**CHAPTER 31**  
**FLOOR CONSTRUCTION**

**General**

**Sec. 3101.** Floor construction shall be of materials and construction as specified under Occupancy in Part III and under Types of Construction in Part V.

All floors shall be so framed and tied into the framework and supporting walls as to form an integral part of the whole building. Fire-resistive standards of floor construction are specified in Section 4303.

The type of floor construction used shall provide means to keep the beams and girders from spreading by installing ties or bridging.

**Concrete Floors**

**Sec. 3102.** Concrete slab floors shall be not less than two and one-half (2½) inches thick. Topping when poured monolithic with the slab may be included as a structural part of the slab. Sleepers for the nailing of a wood floor shall not decrease the required structural depth of the slab unless placed in the direction of span and then shall not be placed more than one-half (½) inch into the slab.

Concrete slab floors may be used in combination with reinforced concrete or steel joists, beams or girders and all such members shall be fireproofed as specified under Types of Construction in Part V. Concrete joists shall be solidly bridged at not more than eight (8) feet centers and such bridging shall be the full depth and width of the joists.

**Steel Joisted Floors**

**Sec. 3103.** Steel joisted floors shall consist of steel joists as specified in Section 2714 and when used in Type I or II buildings shall have a reinforced concrete or gypsum slab not less than two and one-half (2½) inches thick placed on and secured to the top thereof and a ceiling on the under side of not less than one-hour fire-resistive construction fully covering and protecting the joists; provided, that when such joists are used in places where unprotected wood joists are used they need not be protected with fire-resistive materials as specified above. The two-hour fire-resistive ceiling as specified in Section 4301 shall in all cases be designed and constructed to support a load of not less than ten (10) pounds per square foot in addition to its own weight.

Whenever used in Type I or II buildings, steel joists shall be securely electrically welded, riveted or bolted to the supporting beams or girders as specified in Section 2714 so as to form an integral part of the building frame. Compression bridging shall be installed and the whole panel system so designed as to be capable of transmitting horizontal forces into the main skeleton frame of the building.

The reinforced concrete or gypsum slab placed on and secured to the top of the steel joists shall be sufficiently reinforced to support all dead, live and/or other loads between joists. Joists shall be securely cross bridged at not to exceed eight (8) foot intervals along the joists length and the laterally unsupported length of the top cord shall not exceed that allowed in Section 2702.

**Sec. 3104.** Mill constructed floors shall be not less than three (3) inch nominal splined or tongued and grooved plank covered with one (1) inch nominal flooring laid crosswise or diagonal. Top flooring shall not extend closer than one-half ( $1/2$ ) inch to walls to allow for swelling in case the floor becomes wet. Such one-half inch space shall be covered by a moulding fastened to the wall and so arranged that it will not obstruct the swelling or shrinking movements of the floor. Corbeling of masonry walls under floor planks may be used in place of such molding.

**Mill  
Constructed  
Floors**

If laminated floors are used, at least two laminations at the wall shall be omitted until after glazing and roofing has been completed.

Laminated floors consisting of planks not less than six (6) inches wide set on edge close together and spiked at about eighteen (18) inch intervals shall have the joints broken in such manner that no continuous line will occur across the floor and such flooring shall not be spiked to the supporting girders. Joints shall be made only at the supports and at the quarter points with no more than two-thirds ( $2/3$ ) of such joints away from support. Joints between the planks of a laminated floor shall be made and kept tight.

The framing, fire cutting and anchoring of supporting timbers shall comply with the requirements of Chapter 25.

Floor timbers shall be not less than six (6) inches nominal in either cross sectional dimension.

**Sec. 3105.** Wood joisted floors shall be framed and constructed and anchored to supporting wood stud or masonry walls as specified in Chapter 25. Wood joisted floors need not be fire protected on the under side except where specifically required under Occupancy in Part III, Location in Part IV or Type of Construction in Part V.

**Wood  
Joisted  
Floors**

**CHAPTER 32****ROOF CONSTRUCTION AND COVERING**

<b>General</b>	<b>Sec. 3201.</b> Roof covering shall be as required under Occupancy in Part III, Location in Part IV or Types of Construction in Part V. All roofs shall be so framed and tied into framework and supporting walls as to form an integral part of the whole building.
<b>Construction</b>	<p><b>Sec. 3202.</b> The general requirements for construction of floors as specified in Chapter 31 shall apply to roofs except that in mill constructed buildings the roof sheathing shall be not less than two and one-half (2 1/2) inches nominal in thickness and except that concrete or gypsum roof slabs shall be not less than two (2) inches in thickness.</p> <p>Roof trusses shall have all joints well fitted and shall have all tension members well tightened before any load is placed on the truss. Diagonal and sway bracing shall be used to brace all roof trusses. The allowable working stresses of materials in trusses shall be as specified in Chapters 25 and 27. The minimum net section of the members after framing shall be used in determining the strength of the truss at any point.</p>
<b>Design</b>	<b>Sec. 3203.</b> The design of the roof construction shall be in accordance with engineering regulations for the materials used.
<b>Roof Coverings</b>	<b>Sec. 3204.</b> Roof coverings shall be required over all combustible roof construction and shall be of one of the classes specified in Section 4305 as they are specified under Occupancy in Part III, Location in Part IV and Types of Construction in Part V.
<b>Access to Roof Space</b>	<b>Sec. 3205.</b> All buildings shall have access provided to the attic space by means of a stairway or permanent ladder or a scuttle. The openings provided through the ceiling for such access into the attic space shall be not less than two feet by three feet (2 × 3') and shall be located in the hallway or corridor of all Type III and V buildings three (3) stories or more in height.
<b>Roof Drainage</b>	<b>Sec. 3206.</b> Roofs of all buildings shall be sloped so that they will drain to gutters and downspouts which shall be connected with conductors to carry the water down from the roof underneath the sidewalk to and through the curb. Overflows shall be installed at each low point of the roof to which the water drains.

**CHAPTER 33****STAIRS, RAMPS AND SMOKEPROOF TOWERS**

**Sec. 3301.** All exits as required for buildings in this Code shall comply with the requirements specified in this Chapter for a stairway, ramp or smokeproof tower. Wherever stairways are mentioned, ramps may be substituted when constructed as specified in Section 3310. A smokeproof tower constructed as specified in Section 3315 shall be considered as a required stairway as specified in Section 3309. Such smokeproof towers may be substituted for stairways or ramps wherever the latter are required in this Code.

**General  
Require-  
ments**

All stairways shall be constructed of materials permitted for floors as specified under Types of Construction in Part V for that type of building in which such stairways are located, except as specified in Sections 3315 and 3316. All stairways of wood construction shall be protected on the under side by not less than one-hour fire-resistive construction as specified in Chapter 43. Metal stairways entirely enclosed as specified in this Chapter shall not be required to be fireproofed as required for floors in Part V of this Code.

The provisions of this Chapter shall not apply to Group I buildings except as specifically stated in this Chapter.

**Sec. 3302.** All stairways and all platforms, landings and balconies forming a part of such stairway shall be designed to sustain an assumed live load of not less than one hundred (100) pounds per square foot.

**General  
Design**

There shall be no variation in the width of treads in any flight and the variation in heights of risers in any flight shall not exceed three-sixteenths ( $\frac{3}{16}$ ) of an inch. All treads shall have a nosing of not less than one (1) inch.

The surface material of stair treads and landings shall be such as not to involve danger of slipping.

An arrangement of treads known as winders shall be permitted in dwellings or for monumental stairways which are not serving as a required means of exit but in no case shall any tread have a width at any point less than eight (8) inches exclusive of nosing.

Stairways and intermediate landings shall continue with no decrease in width along the direction of exit travel, except that when three or more stairways are required, one-half the required number of stairways may be combined at the second floor level with such combined width extending to the first floor level.

**Sec. 3303.** One-half of the required number of stairways shall be continued their full width to and through the roof by means of a penthouse in all buildings three stories or more in height; provided, that not more than one stairway shall be required to continue to and through the roof when the roof has a slope of more than six (6) inches for each twelve (12) inches of horizontal projection. In two story buildings scuttles not less than two feet by three feet (2' x 3') shall be provided to and through the roof. Stairways leading to roofs of buildings shall have signs conspicuously placed with

**Arrange-  
ment and  
Access**



letters not less than four (4) inches in height indicating such access at the ground floor level.

All stairways shall lead to the street directly or by means of a yard, court or fire-resistive passageway having a width at least equal to the aggregate widths of all the exits discharging into it; provided, that not to exceed one-half of the required number of stairs may terminate at the second floor level provided they lead directly to a street or alley front of the building and are provided with a balcony on the exterior of the building not less than three (3) feet wide and five (5) feet long. Such balcony shall be constructed of incombustible materials and when the floor of such balcony is located more than twelve (12) feet above the sidewalk directly below, such balcony shall be equipped with an approved counterbalanced stairway or ladder.

Where stairways discharge through the fire-resistive passageways such passageways shall be not less than eight (8) feet in clear height and with a width at least equal to the stairway or stairways served by such passageways. All openings into such passageways shall be protected by one-hour fire-resistive doors as specified in Section 4304.

All exits shall be so arranged as to make clear the direction of egress to the exterior of the building and shall be so located that they are readily accessible and visible. When not visible to all occupants, adequate signs shall be provided to indicate their location. For buildings with sleeping rooms, schools and places of detention, exits shall be so arranged that it is possible to go in either direction at any point in a corridor to an exit.

Stairways shall abutt on not more than one side of an elevator enclosure.

Exits shall be so arranged that no part of any floor of a building is more than one hundred and fifty (150) feet distant from the opening of a required exit.

## **Doors**

**Sec. 3304.** Doors shall not open immediately on a flight of stairs but on a landing at least equal to the width of the door.

Doors giving access to stairways shall swing with the direction of exit travel but where swinging doors are not practicable sliding doors approved by the Building Inspector may be permitted. Vertical sliding doors and rolling shutters shall not be used. There shall be no obstructions on stairways or landings nor to the full swing of doors. Swinging doors in their swing shall not reduce the effective width of stairways or landings to less than thirty (30) inches nor when open interfere with the full use of the stairs.

All doors in exit enclosures or providing access to exterior stairways shall be self-closing and be kept normally closed and shall be of not less than one-hour fire-resistive construction as specified in Section 4304, except that doors facing a street and at street level may be of unprotected wood. All doors shall be constructed and installed in a workmanlike and tight fitting manner.

All doors used in connection with exits shall be so arranged as to be readily opened from the side from which egress is made or from both sides when the building is occupied. Locks if provided shall not require a key to operate from the inside.

**Sec. 3305.** All stairways shall have walls or well secured balustrades or guards on each side and handrails shall be placed on at least one side of every stairway and for stairways exceeding forty-four (44) inches in width shall have handrails placed on each side. Stairways over seven (7) feet wide shall be provided with one or more continuous intermediate handrails substantially supported and the number and position of intermediate handrails shall be such that there is not more than sixty-six (66) inches between adjacent handrails.

Handrails and railings shall be placed thirty (30) inches above the nosing of treads and ends of handrails shall be returned to the wall.

**Sec. 3306.** Every stairway or other means of exit into corridors and passageways appurtenant thereto shall be provided with an adequate system of lighting, either natural or artificial. Lights in the exit signs shall be kept burning at all times that the building served by such stairways or exits is being used or occupied.

**Sec. 3307.** Stairways and landings, returns and passageways serving such stairways shall be not less than forty-four (44) inches wide; except, that for dwellings and when serving mezzanines or not more than one family or one apartment in buildings not exceeding two stories in height the required width may be reduced to not less than three (3) feet. All such widths shall be clear of all obstructions; except that handrails attached to walls may project within the required width not more than three and one-half ( $3\frac{1}{2}$ ) inches at each side when the stairway is forty-four (44) or more inches in width and on one side when the stairway width is less than forty-four (44) inches. If newells project above tops of rails a minimum clear width of not less than that specified in this paragraph shall be provided between the face of the newell and the face of the wall or newell opposite.

The rise of stairways shall be not more than seven and one-half ( $7\frac{1}{2}$ ) inches and the tread exclusive of the nosing not less than ten (10) inches (maximum pitch 37 degrees,) and there shall be not more than seventeen (17) risers in any one run between landings; provided, that stairways in dwellings and stairways serving mezzanine floors may have a rise of not more than eight (8) inches and a tread exclusive of the nosing of not less than nine (9) inches.

The walls at the outer corners of landings shall be curved on a radius of at least two (2) feet, or a forty-five (45) degree splay not less than twenty (20) inches wide shall be provided to eliminate right angle corners.

**Sec. 3308.** All required stairways and ramps in buildings three stories or more in height, including landings and parts of floors between stairways which lie in the path of travel shall be enclosed as specified under Occupancy in Part III, under Types of Construction in Part IV, and in Chapter 30; except that monumental stairways leading only from the street floor level to the second floor or basement and which do not constitute required means of exit in public buildings or stores shall be exempted from the enclosure requirements.

## Railings

## Lighting

## Detailed Requirements

## Stairway Enclosures

Exit enclosures shall not be used for storage in any manner whatsoever and shall not contain any material or equipment liable to cause fire, explosion or panic.

At the top of every stairway enclosure a ventilating skylight with a horizontal area of not less than eight (8) square feet shall be installed as specified in Section 3402, or in lieu of such skylight an equivalent window opening glazed with plain glass may be provided in the penthouse walls. Fixed openings not less than five hundred (500) square inches in area shall be provided at the top of each stairway enclosure for ventilation.

### Stairways Required

**Sec. 3309.** The number of stairways provided for each use or occupancy shall be as required in the following tabulation for three story buildings. For two story buildings the allowable areas may be increased fifty (50) per cent. For buildings four stories or more in height the allowable areas shall be decreased two (2) per cent per floor for each floor above the third floor to and including the eighth floor and shall be decreased one (1) per cent for each additional floor above the eighth floor; provided, that in no case shall there be less than two stairways serving each floor for each building three stories or more in height. Where the entire building is sprinkled in accordance with the provisions of Chapter 38 the allowable areas tabulated below may be increased thirty-three and one-third ( $33\frac{1}{3}$ ) per cent.

The number of required stairways for Group A, B and C buildings is specified in Chapters 6, 7 and 8, respectively.

#### Basic Areas for Computing Required Number of Stairways

No. of Stair- ways Re- quired	Maximum Areas for Types I and II Buildings (Sq. Ft.)				
	Group D Buildings	Group E Buildings	Group F Buildings	Group G Buildings	Group H Buildings
1	Up to 3,000	Up to 4,000	Up to 5,000	Up to 6,000	Up to 3,000
2	Up to 8,000	Up to 9,000	Up to 12,000	Up to 12,000	Up to 9,000
3	Up to 18,000	Up to 20,000	Up to 25,000	Up to 25,000	Up to 20,000
4	Up to 28,000	Up to 30,000	Up to 40,000	Up to 40,000	Up to 30,000
5	Up to 40,000	Up to 40,000	Up to 57,000	Up to 60,000	Up to 42,000
6	Up to 54,000	Up to 50,000	Up to 76,000	Up to 85,000	Up to 56,000
7	Up to 70,000	Up to 60,000	Up to 97,000	Up to 115,000	Up to 72,000
8	Up to 88,000	Up to 70,000	.....	.....	Up to 90,000
9	Up to 108,000	Up to 80,000	.....	.....	Up to 110,000
10	.....	Up to 90,000	.....	.....	.....
	Maximum Areas for Types III, IV and V Buildings (Sq. Ft.)				
	Group D Buildings	Group E Buildings	Group F Buildings	Group G Buildings	Group H Buildings
1	Up to 3,000	Up to 4,000	Up to 5,000	Up to 6,000	Up to 3,000
2	Up to 8,000	Up to 9,000	Up to 12,000	Up to 12,000	Up to 9,000
3	Up to 15,000	Up to 17,000	Up to 21,000	Up to 24,000	Up to 17,000
4	Up to 24,000	Up to 27,000	Up to 32,000	Up to 38,000	Up to 26,000
5	Up to 35,000	Up to 38,000	Up to 45,000	Up to 56,000	Up to 37,000
6	Up to 48,000	Up to 52,000	Up to 60,000	Up to 79,000	Up to 50,000
7	Up to 63,000	Up to 68,000	Up to 77,000	Up to 108,000	Up to 65,000
8	Up to 80,000	Up to 86,000	Up to 96,000	.....	Up to 82,000

Exceptions: (1) Group D buildings shall be provided with not less than one smokeproof tower constructed as specified in Section 3315 when such building exceeds two stories in height.

(2) Group E—In automobile storage garages, where a system of ramps continuous from the ground floor to the top floor is used to transport automobiles from floor to floor, the number of stairways required shall be not less than one-half that shown in the above tabulation.

(3) Under no circumstances shall the required number of stairways be less at any point in any building above third floor level than necessary to accommodate one hundred (100) persons per forty-four (44) inch width of stairway based upon the total number of occupants in the building above that point.

(4) Where one horizontal opening is provided, the allowable areas tabulated may be increased fifteen (15) per cent and where more than one such exit is provided, such areas may be increased not to exceed twenty-five (25) per cent.

Stairways or exits shall be so located that no point in a building three stories or more in height is more than seventy-five (75) feet distant from a required means of egress.

**Sec. 3310.** Wherever stairways are required by this Code, ramps with a slope not greater than one (1) foot in eight (8) feet may be substituted.

Ramps shall comply with all the requirements for stairways as to construction, width, enclosures, landing, lighting and ventilation.

Ramps shall be surfaced with an approved non-slip material.

Handrails shall not be required where the slope of the ramp is less than one (1) foot in ten (10) feet.

#### **Ramps**

**Sec. 3311.** A horizontal exit shall consist of one or more protected openings through or around an exterior or fire wall or of one or more bridges connecting two buildings or parts of buildings entirely separated by fire walls.

#### **Horizontal Exits**

Openings used in connection with horizontal exits shall be protected by one-hour fire-resistive doors as specified in Section 4304. If swinging doors are used there shall be adjacent openings with doors swinging in opposite directions, with signs on each side of the wall indicating the exit door which swings with the travel from that side.

Such doors shall be kept continuously unlocked whenever the building is occupied and be normally closed or be self-closing and equipped with fusible links.

**Sec. 3312.** Signs having white letters not less than five (5) inches high on a red field indicating location of exits shall be provided not only at the exit but at other points in the building wherever necessary to clearly indicate the direction of egress. Lights shall be kept burning during all times that the building is used or occupied.

#### **Signs and Lighting**

**Sec. 3313.** Safe and continuous passageways, aisles, or corridors leading to exits and so arranged as to provide convenient access to exits for every occupant shall be maintained at all times on all floors and buildings.

#### **Passageways and Corridors**

The minimum clear width of any passageway, aisle or corridor shall be three (3) feet at the narrowest point and doors swinging into such passageway shall not restrict the effective width at any point during their swing to less than the minimum width herein specified.

**Exceptions**

**Sec. 3314.** Stairways in dwellings, stairways serving only one apartment not above the second floor level, or stairways leading to mezzanine floors not exceeding one thousand (1000) square feet in area are exempted from the width, rise, tread and enclosure provisions in this Chapter but in no case shall such stairways have a rise of more than eight (8) inches and a tread exclusive of the nosing of less than nine (9) inches.

**Smokeproof Tower**

**Sec. 3315.** (1) Where required. A smokeproof tower consisting of a stairway with exterior access, entirely closed by masonry walls of not less than four-hour fire-resistive construction and floors and ceilings of not less than two-hour fire-resistive construction as specified in Chapter 43 and constructed as specified in this Section shall be required in every building of Group D, E, F, G and H occupancies five stories or more in height. Smokeproof towers shall be installed in Group A, B and C buildings as specified in Chapters 6, 7 and 8, respectively.

(2) Construction. The stairways, landings, platforms and balconies of smokeproof towers shall be constructed as required for stairways, except that they shall be of incombustible materials throughout, except for handrails which may be of wood. The enclosure shall extend from the street level to a penthouse on the roof of the building and shall be roofed over with incombustible materials. Light and ventilation shall be provided at the top of every such enclosure as required for stairways.

Balustrades on the vestibules and balconies shall be not less than three feet and six inches (3'-6") in height. Exit lights shall be provided as required in Section 3312.

(3) Access and Egress. Access to the smokeproof tower shall be provided from each story by means of vestibules open to the outside on an exterior wall or by means of balconies overhanging an exterior wall but not subject to severe fire exposure. Every such vestibule, balcony or landing shall have an unobstructed length not less than the combined required width of exit doors opening upon such balcony or landing and shall be directly open to a street, alley or yard or to an enclosed court open at the top and not less than fifteen (15) feet in width and six hundred (600) square feet in area.

Access from the building to vestibules or balconies and to the enclosure shall be through doorways not less than thirty (30) inches wide nor less than seventy-five (75) inches in clear height. These openings shall be provided with self-closing fire doors of not less than one-hour fire-resistive construction as specified in Section 4302, swinging in the direction of exit travel; provided that clear wire glass not exceeding seven hundred and twenty (720) inches in area shall be provided in all such doors giving access to the enclosure from the balcony or vestibule. Where locks or latches are provided they shall be of an approved pressure-release type and shall be so designed as to provide access into the building at every floor and roof level.

Stairways of smokeproof towers shall provide continuous uniform egress from the roof and all stories to street grade. Egress shall be provided at the ground floor level either directly or through a passageway not less

than forty-four (44) inches in clear width and eight (8) feet in clear height to a street, yard or alley not less than ten (10) feet in width. The walls of such passageway shall be of not less than four-hour fire-resistive construction and the ceiling and floor of not less than two-hour fire-resistive construction as specified in Chapter 43. The walls of any such passageway shall be unpierced throughout their entire length.

(4) Location. Every smokeproof tower required by this Code shall be located so as to furnish the best means of egress for the occupants of the building and access shall be provided thereto by means of a public room, public hall or passageway not less than thirty-six (36) inches in clear width and in no case shall access thereto be through another apartment, guest room, office or private room of any nature.

**Sec. 3316.** Outside stairways of the return platform or straight run type may be used as a required means of exit for buildings not exceeding five stories or fifty-five (55) feet in height but in no case shall such stairways constitute more than fifty (50) per cent of the required exit capacity. All outside stairways shall be located so as to lead directly to a street or alley or to a yard directly connected with a street or alley.

### **Outside Stairways**

The stairways, landings, platforms and balconies shall be constructed as specified for stairways in this Chapter, except that they shall be of incombustible materials throughout; provided that stairways serving only the second floor may be constructed of combustible material. Structural metal shall be not less than one-quarter ( $\frac{1}{4}$ ) inch thick and shall be so framed as to permit ready access for inspection and painting. All windows and other openings adjacent to such stairways shall be provided with fixed metal covered sash and frames and wire glass or be provided with shutters or doors of one-hour fire-resistive construction as specified in Chapter 43.

No part of any such outside stairway shall be within ten (10) feet of a lot line which does not form the boundary of a street or alley.

## CHAPTER 34

## DOORS, WINDOWS AND SKYLIGHTS

**Doors and  
Windows**

**Sec. 3401.** Fire doors where required shall be as specified in Section 4304. All such doors shall be self-closing and if not kept normally closed shall be arranged to close automatically with the fusing of an approved fusible link.

Windows required to have metal frames shall be constructed either of steel or wrought iron rolled shapes or of hollow galvanized sheet iron as specified in Section 4304.

When wire glass is required, it shall mean glass the thickness of which at the thinnest point shall not be less than one-fourth ( $\frac{1}{4}$ ) of an inch and in which a wire netting is embedded. Wire glass shall be set with putty and metal stops.

**Skylights**

**Sec. 3402.** All skylights constructed with metal frames shall be substantially built with interlocking seams. All skylights, the glass of which is set at an angle of less than forty-five (45) degrees from the horizontal, if located above the first story, shall be set at least one (1) foot above the roof. The curbs on which the skylight rests shall be constructed as required for inner court walls or for exterior masonry walls.

When wire glass is required for skylights the size shall not exceed seven hundred and twenty (720) square inches in area or forty-eight (48) inches in any dimension in any one panel. All glass in skylights shall be wire glass, except that skylights over vertical shafts extending through two or more stories shall be glazed with plain glass as specified in this Section; provided, that wire glass may be used if ventilation equal to not less than one-eighth ( $\frac{1}{8}$ ) the cross sectional area of the shaft but never less than four (4) feet is provided at the top of such shaft.

Any glass not wire glass shall be protected above and below with a screen constructed of wire not smaller than No. 12 B. and S. gauge with a mesh not larger than one (1) inch. The screen shall be substantially supported below the glass.

Skylights installed for the use of photographers may be constructed of metal frames and plate glass without wire netting.

Ordinary glass may be used in the roofs and skylights for greenhouses, provided the height of the greenhouse at the ridge does not exceed twenty (20) feet above the grade. The use of wood in the frames of skylights will be permitted in greenhouses outside of Fire Zones No. 1 and 2, if the height of the skylight does not exceed twenty (20) feet above the grade, but in other cases metal frames and metal sash bars shall be used.

Glass used for the transmission of light, if placed in floors or sidewalks, shall be supported by metal or reinforced concrete frames, and such glass shall be not less than one-half ( $\frac{1}{2}$ ) inch in thickness. Any such glass over sixteen (16) square inches in area, shall have wire mesh embedded in the same or shall be provided with a wire screen underneath as specified for skylights in this Section. All portions of the floor lights or sidewalk lights shall be of the same strength as is required by the Code for floor or sidewalk construction, except in cases where the floor is surrounded by a railing not less than three feet and six inches (3'-6") in height, in which case the construction shall be calculated for not less than skylight loads.

## CHAPTER 35

## BAYS AND BALCONIES

**Sec. 3501.** Construction of walls and floors in bay and oriel windows shall conform to the construction allowed for exterior walls and floors of the Type of Construction of the building to which they are attached. The roof covering of a bay or oriel window shall conform to the requirements for roofing of the main roof of the building.

**Construc-  
tion**

All exterior balconies attached to or supported by masonry walls shall have brackets or beams constructed of wire, steel, concrete or other incombustible material. All railings for balconies or porches shall be not less than three feet and six inches (3'-6") in height above the floor of such balcony or porch. Balconies shall be designed to support in addition to their own weight a live load of not less than one hundred (100) pounds per square foot. Railings of balconies shall be designed to support a horizontal thrust of not less than twenty (20) pounds per lineal foot of railing uniformly distributed along its length.



## CHAPTER 36

## PENTHOUSES AND ROOF STRUCTURES

**Penthouses  
and Roof  
Structures**

**Sec. 3601.** No penthouse or other projection above the roof shall exceed twenty-eight (28) feet in height above the roof when used as an enclosure for tanks or for elevators which run to the roof and in all other cases shall not extend more than twelve (12) feet in height above the roof. The aggregate area of all penthouses and other roof structures shall not exceed twenty (20) per cent of the area of the roof. No penthouse, bulkhead or any other similar projection above the roof shall be used for manufacturing, business, habitation, office or storage, except that they shall be permitted to be used for the making of blue prints, photographic prints, for scientific observation, for summerhouses or for private dwellings.

Roof structures of Type I buildings shall be constructed with walls, floors and roof as required for the main portion of the building.

Walls of roof structures parallel to and within four (4) feet of the exterior walls of Type II or III buildings shall be constructed the same as the exterior wall of the story immediately below. Such wall shall project two (2) feet above the roof and two (2) feet beyond the sides of such roof structure, except that the side projection shall not be required when the adjoining side walls are of masonry. Walls other than those occurring within four (4) feet of an exterior wall on Type II or III buildings shall be of not less than one-hour fire-resistive construction. The restrictions of this paragraph shall not prohibit the placing of wood flagpoles or similar structures on the roof of any building.

**Towers  
and  
Spires**

**Sec. 3602.** Towers or spires when enclosed shall have exterior walls as required for the building to which they are attached. Towers not enclosed and which extend more than seventy-five (75) feet above grade shall have their framework constructed of iron, steel or reinforced concrete. No tower or spire shall occupy more than one-fourth ( $\frac{1}{4}$ ) of the street frontage of any building to which it is attached and in no case shall the base area exceed sixteen hundred (1600) square feet unless conforming entirely to the Type of Construction requirements of the building to which it is attached and being limited in height as a main part of the building. If the area of the tower or spire exceeds one hundred (100) square feet at any horizontal cross section its supporting frame shall extend directly to the ground. The roof covering of spires shall be as required for the main roof of the rest of the structure.

Skeleton towers used as wireless masts and placed on the roof of any building shall be constructed entirely of incombustible materials when more than twenty-five feet in height and shall be directly supported on an incombustible framework to the ground. They shall be designed to withstand a wind load from any direction as specified in Section 2307 in addition to any other loads.

**CHAPTER 37****Chimneys and Heating Apparatus****Chimneys**

**Sec. 3701.** Chimneys shall be constructed in conformance with "A Standard Ordinance for Chimney Construction" recommended by the National Board of Fire Underwriters, Third Edition, revised 1927, except as specified in this Chapter.

The walls of all chimneys whether used for appliances using coal, coke, wood, gas or oil shall be built of brick, concrete, stone, hollow tile of clay or concrete or of concrete blocks; provided that a metal smokestack as specified in Section 3702 may be used.

Flue linings shall be made of fire clay or of other suitable refractory clays adapted to withstand reasonably high temperatures and flue gases and shall have a softening point not lower than nineteen hundred and ninety-four (1994) degrees Fahrenheit. Flue linings shall be not less than five-eighths ( $\frac{5}{8}$ ) of an inch in thickness and shall be built in as the outer walls of the chimney are constructed. All joints and spaces between the masonry and lining shall be thoroughly slushed and grouted full as each course of masonry is laid. Cracked, broken or otherwise defective linings shall not be used. Flue linings shall start from a point not less than eight (8) inches below the center line of smoke pipe intakes or in the case of fireplaces from the apex of the smoke chamber and shall be continuous to a point not less than four (4) inches above the enclosing walls. Flue lining may be omitted in brick chimneys for residence buildings provided the walls of the chimneys are not less than eight (8) inches thick and that the inner course shall be of fire brick with a fire resistance equal to that required for flue linings.

The walls of brick chimneys shall be not less than three and three-fourths ( $3\frac{3}{4}$ ) inches thick and shall be lined except as provided above. All brick work shall be laid with full mortar joints and shall be struck smooth where exposed to the weather. No mortar lining shall be permitted.

Concrete chimneys cast in place shall be suitably reinforced vertically and horizontally. The walls shall be not less than three and three-fourths ( $3\frac{3}{4}$ ) inches thick and shall have a flue lining as specified in this Section; provided, that flue linings may be omitted in reinforced concrete chimneys for private dwellings when the walls of such chimneys are not less than six (6) inches thick.

Hollow blocks or building tile of clay or concrete shall not be used for the walls of an independent chimney but may be used for chimneys built in connection with exterior party walls of hollow units for buildings not exceeding three stories in height. The outer eight (8) inches of such a wall may serve as the outside wall of the chimney.

Chimneys shall extend at least three (3) feet above flat roofs and not less than two (2) feet above the ridge of the gable and hip roofs or the high point of mansards irrespective of the distance of the chimney from such obstruction to draft.

Chimneys shall be built upon solid masonry or reinforced concrete foundations properly proportioned to carry the weight imposed without settlement or cracking. The chimney shall carry no load except its own weight and such load shall be transmitted to the foundation in such manner as to prevent the shearing or falling off of any part of the chimney. The footing for an exterior chimney shall start below the frost line.

Flues shall be built as nearly vertical as possible and in no case at an angle greater than thirty (30) degrees from the vertical.

When any single flue has an effective area exceeding two hundred (200) square inches the wall shall be not less than eight (8) inches thick and shall have flue lining as specified in this Section, except that when flues become too large for fire clay flue lining such flues shall be lined with fire brick for a distance at least twenty-five (25) feet from the point of intake.

There shall be but one connection to a flue irrespective of whether the fuel used be coal, coke, wood, oil or gas. Ordinary and low pressure heating devices burning solid fuels shall have a minimum effective flue area of not less than the following, and such area shall be provided by a flue having its short dimension not less than two thirds ( $\frac{2}{3}$ ) the long dimension.

Small special stoves and heaters	.....28 sq. inches
Stoves, ranges and room heaters	.....40 sq. inches
Fireplaces (at least $\frac{1}{12}$ the fireplace opening)	.....50 sq. inches
Warm air furnaces, steam and hot water boilers	.....70 sq. inches

All flues to which large ranges, heating furnaces, boilers, automatic gas water heaters or fireplaces are to be connected shall be subjected to a smoke test before acceptance but the test shall not be made until the mortar has thoroughly seasoned. Such test shall be made by the mason contractor in the presence of the Building Inspector.

**Smoke-  
stacks**

**Sec. 3702.** Steel or iron smokestacks may be used in place of brick chimneys specified in Section 3701, in which case the thickness of the metal shall be not less than one-fourth ( $\frac{1}{4}$ ) of an inch. Such stacks when used for manufacturing, for high pressure boilers, furnaces or other similar heating or manufacturing appliances shall be lined with fire brick for a distance of not less than twenty-five (25) feet from the place where the smoke pipe enters and shall be protected on the outside up to and through the roof of the building with eight (8) inches of masonry or a metal shield which provides an eight (8) inch ventilated air space between such shield and the steel or iron stack; provided, that a metal smokestack when located inside of a vent shaft having masonry enclosing walls not less than eight (8) inches thick and having an air space between the walls and the stack on all sides may have such masonry or metal shield protection omitted when placed outside of the building. All stacks shall be properly guyed when the height of the stack exceeds fifteen times its least diameter.

Smokestacks constructed of not less than number ten (10) U.S. Gauge steel, with either welded or riveted joints, may be mounted directly upon industrial, heating and/or power boilers which are designed to support the stack load. A clearance of not less than six (6) inches shall be maintained at all times around such smokestack and any inflammable material within twelve (12) inches of such smokestack shall be protected by one-fourth ( $\frac{1}{4}$ ) of an inch of asbestos covered by sheet metal.

**Gas  
Vents**

**Sec. 3703.** Gas furnaces and individual gas room heaters may, in lieu of the chimney required in Section 3701, be provided with a vent of unglazed fire clay or concrete tile pipe not less than one-half ( $1/2$ ) inch in thickness and having a sleeve or flange not more than twenty-four (24) inches apart and at every joint in such vent pipe. Such sleeves or flanges shall project at least three-fourths ( $3/4$ ) of an inch beyond the outer surface of the joint and shall securely join the sections of such vent shall be not less than the area of all of the vent connections of all the appliances connected thereto and served by the vent at that point. Not more than three (3) appliances shall be connected to any such vent, except that the various units of a unit furnace may be combined and be connected to one vent.

A single galvanized or copper bearing metal vent connection exposed to view in a room throughout its entire length may be used to connect the appliance to the vent. Such metal vent connection shall be not less in diameter than the connection on the appliance and shall be maintained not less than six (6) inches distant from any combustible portion of the building or the combustible material shall be protected by not less than one-hour fire-resistive construction as specified in Chapter 43. Every portion of a vent connection shall have a rise of not less than one-half ( $1/2$ ) inch to the foot from the appliance to the chimney and the length of such connection shall be no greater than the height of the vent from the point at which the vent connection enters to the top of the vent.

Every vent shall extend in as nearly a vertical position as possible and be continuous from the gas appliance to the outside of the building and extend at least one (1) foot above the highest portion of the building or any adjoining building within fifteen (15) feet thereof. No gas vent in any part thereof shall be inclined more than thirty (30) degrees from the vertical.

Gas furnaces and automatic gas appliances shall not be connected in the same vent with any other appliance.

**Sec. 3704.** Patent chimneys may be used, except for fireplaces, when complying with the requirements of this Section.

**Patent  
Chimneys**

All patent chimneys shall be constructed with a flue lining enclosed in a metal outer casing which is so arranged as to provide not less than a one (1) inch air space between the flue lining and the casing. The flue lining shall be made of fire clay or suitable refractory clays adopted to withstand reasonably high temperatures and flue gases, shall have a softening point not lower than nineteen hundred and ninety-four (1994) degrees Fahrenheit and shall be not less than one (1) inch in thickness. Such chimneys shall be built up from the floor level on which they are used and in no case shall a stove pipe enter the bottom of a patent chimney nor shall such chimneys be used for fireplaces.

When such chimneys are erected on the outside of a building they shall be supported by a substantial iron bracket attached to the studs or framework of the building with through-bolts. When erected on the inside of a building such patent chimneys shall be provided with a smokeproof clean-out of approved design at or near the floor. The floor on which they are placed shall be protected by not less than eight (8) inches of masonry or terra cotta set on a one-fourth ( $1/4$ ) inch metal plate. Partitions enclosing

patent chimneys shall have an opening opposite the clean-out on the chimney for the purpose of cleaning the flue.

All patent chimneys shall be built plumb and without bends. All joints in such chimneys shall be made with cement mortar and the bands covering the joints shall be of not less than twenty-four (24) U.S. Gauge galvanized iron. All patent chimneys shall be braced every six (6) feet in their height by not less than sixteen (16) gauge wire secured to the chimney by locks or collars and extending in at least three directions.

Not more than two inlets for smoke pipes will be permitted in any patent chimney. When only one inlet is provided the flue shall be not less than six (6) inches in diameter and shall be not less than eight (8) inches in diameter where two inlets are provided.

All galvanized iron used for the casing of patent chimneys shall be of twenty-four (24) U.S. Gauge riveted together with rivets not more than three (3) inches apart or seamed and with such seams secured with rivets at the top and bottom of each section. There shall be not less than one (1) inch clearance between the chimney and the casing at all points and such casing shall be ventilated by not less than six (6) one (1) inch holes punched near the top of the chimney above the roof so as to permit the escape of hot air.

**Smoke  
Pipes  
and  
Thimbles**

**Sec. 3705.** All smoke pipes shall be as short and straight as possible. Smoke pipes for furnaces, boilers or apparatus burning solid or liquid fuel shall be constructed of black iron of not less than twenty-four (24) U.S. Gauge or masonry and shall fit tightly into the chimney. Galvanized iron shall not be used.

Smoke pipes shall enter the side of chimneys through a fire clay or metal thimble or a flue-ring of masonry. The top of smoke pipe intakes shall be set not less than eighteen (18) inches below sheet metal ceilings, wood lath and plaster or exposed wood framing. Neither the intake pipe nor the thimble shall project into the flue. No wood-work shall be placed within six (6) inches of the thimble. When a smoke pipe enters a chimney breast through a studded off chimney partition the thimble shall be kept six (6) inches clear of all woodwork.

**Fire-  
Places**

**Sec. 3706.** All fireplace walls shall be not less than eight (8) inches thick and if built of stone or hollow units shall be not less than twelve (12) inches thick. The faces of all such minimum thickness walls exposed to fire shall be lined with fire brick, soap stone, cast iron or other suitable fire-resistive material. When lined with four (4) inches of fire brick such lining may be included in the required minimum thickness. All fireplaces shall be connected to a regulation chimney as specified in Section 3701.

All fireplaces and chimney breasts shall have trimmer arches or other approved fire-resistive construction supporting hearths. The arches and hearths shall be not less than twenty (20) inches wide measured from the face of the chimney breast and not less than twelve (12) inches wider than the fireplace opening on each side. The arches shall be of brick, stone or

hollow tile not less than four (4) inches thick. A flat stone or reinforced concrete slab may be used to carry the hearth instead of an arch if it be properly supported and a suitable fill provided between it and the hearth. Hearths shall be of brick, stone, tile or concrete. Wood centering under a trimmer arch shall be removed after the masonry has thoroughly set.

False fireplaces for gas or electrical heaters shall not be constructed in imitation of fireplaces unless complying with all the requirements for fireplaces and shall not be recessed into the wall more than six (6) inches in any case.

No heater burning solid or liquid fuel shall be placed in a fireplace which does not comply with the requirements of this Section. No such heaters shall be connected to a gas vent flue. No wood shall be placed within eight (8) inches of the jambs or within twelve (12) inches of the top or arch of any fireplace opening.

**Sec. 3707.** Warm air furnaces may be used for heating buildings not over three stories in height. Such furnaces shall be encased in a double metal shield with an air space between and shall be protected with at least three (3) inches of sand on top and shall rest on masonry or concrete floors. No wood partitions shall be built within seven (7) feet of the front or four (4) feet of the sides of the outer shield of such furnaces, but the distance to the partitions at the side may be reduced to two (2) feet if they are covered with sheet metal or metal lath and plaster. The distance from the top shield of such furnace to any ceiling or framing of wood above shall be not less than twenty-four (24) inches unless such wood ceiling or framing is protected with not less than one-hour fire-resistive construction.

### **Warm Air Furnaces**

Every furnace designed to burn solid or liquid fuel shall set upon a masonry floor or be placed on a bed of not less than four (4) inches of masonry and every portion thereof including the smoke pipe shall be at least two (2) feet from any combustible material or such combustible material shall be protected by a covering of number twenty-four (No. 24) U.S. Gauge galvanized iron furred with metal furring not less than one and one-half (1-1/2) inches from such combustible construction or shall be entirely covered by one-hour fire-resistive construction. Any such furnace set in brick shall be completely and tightly covered with at least four (4) inches of brick, concrete, tile, sand or a combination of such materials. Every such furnace shall be connected to a regulation chimney as specified in Section 3701.

Every gas furnace other than single pipe floor furnaces shall be set in a furnace room upon a masonry floor or shall be set upon not less than two (2) inches of masonry. Every such furnace shall be vented into a regulation chimney as specified in Section 3701 or as provided in Section 3703.

An air supply shall be provided for every gas furnace. Such supply may be from the outside air into the furnace room, from the inside of the building into the furnace room or from either source direct to the furnace by means of cold air pipes or ducts constructed of metal or other incombusti-

ble material. Where the air supply is taken from the outside air one or more openings shall be provided into the furnace room and such openings shall have a net area of not less than four hundred (400) square inches. No obstructions of any kind shall be placed over such ducts except a wire netting with openings not less than one-half (1/2) inch square.

The furnace room or rooms shall be located in the basement or cellar of any building having a gravity system and the least horizontal dimension of such room shall be six (6) feet. The floor of the furnace room shall be not less than seven (7) feet in the clear below the bottom of the lowest joists of any floor under which lateral heat pipes from the furnace or furnaces are taken and such floor shall be constructed of incombustible materials. An opening into such furnace room space not less than thirty inches by thirty-six inches (30" × 36") shall be provided.

**Low  
Pressure  
Steam  
Heating  
Plants**

**Sec. 3708.** Steam hot water heating plants, for not more than fifteen (15) pounds pressure, and hot water heaters using solid or liquid fuel, shall rest upon masonry or reinforced concrete floors and shall be protected on the outside by asbestos. The clearance of wooden partitions, ceilings, and other combustible materials shall be the same as given for warm air furnaces.

**Boilers**

**Sec. 3709.** Large boilers for power or steam purposes or for generating high pressure steam shall be so located that no wood or other combustible material shall be less than five (5) feet from the top or sides or ten (10) feet from the front of such apparatus and all combustible material less than ten (10) feet from the top or sides or less than twenty (20) feet from the front shall be protected with at least four (4) inches of concrete, brick or other similar incombustible material and shall be well ventilated to prevent the temperature rising above one hundred and twenty-five (125) degrees Fahrenheit. Steel, cast iron or concrete columns adjacent to such boilers shall not be in direct contact with furnace settings but there shall be an open and unobstructed space at least four (4) inches wide for ventilation.

**Stoves**

**Sec. 3710.** All stoves used for heating, cooking or laundry purposes using solid or liquid fuel or gas shall have all combustible partitions in back of and extending not less than twelve (12) inches beyond each side of such stove protected by not less than one-hour fire-resistive construction as specified in Chapter 43. Such stoves shall be securely supported at least twelve (12) inches above any wood floors by metal supports and there shall be a metal and asbestos pad at least three-eighths (3/8) of an inch thick below such stove extending at least six (6) inches beyond each side and at least twelve (12) inches in front of such stove. Such stoves shall not be placed nearer than six (6) inches to any combustible partition.

All such stoves shall be connected by a smoke pipe to a chimney meeting the requirements specified in Section 3701.

**Sec. 3711.** Gas ranges, domestic hot water heaters and hot plates shall be supported at least six (6) inches above any wood floor or other combustible material and where burners are not provided with a shield below, the wood or other combustible material shall be protected with a double metal shield and with a one (1) inch air space between or with a one-half ( $\frac{1}{2}$ ) inch pad of metal and asbestos. Combustible partitions or walls in back of such ranges, domestic hot water heaters and hot plates shall be protected by one-fourth ( $\frac{1}{4}$ ) of an inch of asbestos covered with a twenty-six (26) gauge metal covering or shall have not less than a one-hour fire-resistive protection as specified in Chapter 43. Wood ceilings or other combustible materials shall be at least three (3) feet above such installations. The oven of ranges and all water heaters shall be connected to a vent pipe meeting the requirements of Section 3703 or to a regulation chimney as specified in Section 3701.

**Gas  
Ranges,  
Domestic  
Water  
Heaters  
and Hot  
Plates**

**Sec. 3712.** Gas ranges for restaurants, bakeries or hotels shall be supported at least six (6) inches above any wood floor and if less than twelve (12) inches above the floor, the wood shall be protected by a metal shield or such ranges may rest on a steel and masonry support. Such ranges shall not be placed nearer to any wood partition or other combustible material than six (6) inches and if nearer than twelve (12) inches, such partitions shall be protected with a metal or asbestos shield. The distance from any such range to any wood ceiling or other combustible material above shall not be less than twelve (12) inches; and if less than three (3) feet, the ceiling or combustible material above shall be protected with a double metal shield with one (1) inch air space between or with one (1) inch of metal lath and Portland cement plaster or one (1) inch of asbestos. Hood and ventilating flues from such ranges may be of sheet metal or masonry and if of sheet metal shall be protected from all wood or other combustible materials by four (4) inches of concrete, gypsum or terra cotta tile or an eight (8) inch air space and a metal shield. Such ventilating flues shall not be carried through wood floors or up combustible partitions unless protected by at least four (4) inches of masonry or concrete.

**Gas  
Ranges  
For Res-  
taurants  
and Hotels**

**Sec. 3713.** Stoves, furnaces and other heating or power apparatus in which oil burners are installed shall be constructed and erected as required for similar apparatus using solid fuel.

**Oil  
Burners**

Oil burning apparatus using commercial fuel oil, furnace oil, diesel oil or other inflammable liquids shall be constructed and installed in compliance with the regulations of the National Board of Fire Underwriters for the Construction and Installation of Oil Burning Equipments and for the Storage and Use of Oil Fuels in Connection Therewith recommended by the National Fire Protection Association, Edition of 1925.

**Sec. 3714.** Other sources of heat and flame not specifically mentioned herein shall be constructed and so protected as to prevent heating any wood or other combustible material used in the construction of floors, ceilings,

**Other  
Sources  
of Heat**



partitions or other parts of a building to a temperature of over one hundred and twenty-five (125) degrees Fahrenheit, when in full operation, and shall be so constructed as not to be liable to undue corrosion or deterioration and not subject to accidental overturn or other disarrangement conducive to dangerous conditions.

**Warm Air  
Ducts and  
Appurten-  
ances**

**Sec. 3715.** For gravity systems no leader heat pipes shall be over twenty (20) feet in length measured horizontal, except where a booster fan is installed when such length shall not exceed forty (40) feet. All such pipes under first floor joists shall have a uniform rise of at least one (1) inch per lineal foot of horizontal run. Warm air pipes and appurtenances serving first floor rooms shall have a minimum cross sectional area in square inches of not less than the cubic foot capacity of the room or rooms in which registers are located, divided by forty (40); provided, that no leader pipe shall have a net area less than thirty-eight (38) square inches. Risers and appurtenances serving floors above the first floor shall have a net area of not less than two-thirds ( $\frac{2}{3}$ ) that required to serve the first floor.

Registers shall be located in or near the wall of the room nearest the furnace. No register shall be located in outside walls except in cases of absolute necessity. Where double registers are supplied by one leader pipe each register shall have a capacity of not less than two-thirds ( $\frac{2}{3}$ ) the area of the leader pipe. When necessary to install appurtenances in an outside wall at least the weather side shall be covered with air-cell asbestos paper.

Ninety (90) degree bends in round pipe shall be made by not less than four (4) piece elbows. Sixty (60) degree bends shall be made by means of not less than three (3) piece elbows. All warm air pipes and fittings, cold air or recirculating pipes, ducts, boxes and fittings shall be made of bright tin or galvanized iron. All such appurtenances except leader heat pipes under the first floor shall be covered with two thicknesses of asbestos paper weighing at least eight (8) pounds to one hundred (100) square feet or with air-cell asbestos insulation or shall be double walled with a one-fourth ( $\frac{1}{4}$ ) inch space between the inner and outer walls. Horizontal warm air pipes shall be kept at least three (3) inches from any combustible material or shall be protected with an asbestos shield and a one (1) inch air space. Air-cell asbestos paper not less than one-fourth ( $\frac{1}{4}$ ) of an inch in thickness shall be securely cemented around all leader pipes.

All riser pipes shall be braced or held in place by means of metal strips securely fastened to the pipe and shall in no case be held in place by nailing diagonally through the corners of such pipe. No joint shall depend wholly upon solder to make it tight. All leader pipes shall be securely fastened in place by means of wires or metal strips.

In the installation of Y runs or branch runs the cross sectional area of the warm air pipe at the furnace shall equal in square inches the cubic contents of all the rooms served by such warm air pipe divided by forty (40). Sizes of branch runs shall be determined in the same manner on the basis of the room or rooms served. Branches from trunk lines shall be taken off in a

generally horizontal plane at an angle not less than forty-five (45) degrees from the line of the pipe. Riser pipes shall not be taken off the top of the first floor register boxes.

Where warm air pipes and appurtenances are to be installed in a building the joists and studs shall be so arranged as to provide not less than fourteen (14) inches clear space in continuous horizontal runs and/or vertical risers from the gas furnace to the register served.

**Sec. 3716.** All incinerators shall have the enclosing walls of the fire boxes or combustion chamber of solid masonry or reinforced concrete not less than eight (8) inches in thickness where the horizontal area does not exceed fifteen (15) square feet and not less than twelve (12) inches in thickness where the combustion chamber is of greater area. The inner four (4) inches of such combustion chamber walls shall be of fire brick laid in fire clay or cement mortar, except that the walls surrounding the ash chamber below the fire grate need not be so lined. The inner walls of any combustion chamber shall not be offset in excess of one (1) inch for every three (3) inches of rise in the height of the wall unless supported by reinforced concrete or structural steel.

**Inciner-  
ators**

Chimneys for every incinerator shall be as specified in Section 3701.

**CHAPTER 38**

**FIRE EXTINGUISHING APPARATUS**

**Automatic  
Sprinklers;  
Where Re-  
quired**

**Sec. 3801.** Standard automatic sprinklers shall be installed as specified in this Chapter in the following places:

1. In the cellar of every building.
2. Under the roof above the stage, under the floor of the stage, under all fly and tie galleries, under the gridiron, in all dressing rooms, store rooms, property rooms, carpenter shops, paint shops, passageways and all other places back of the proscenium wall; a line of sprinklers shall be installed in the arch of the proscenium opening in front of ever proscenium curtain in all Group A buildings; in all motion picture projection rooms or booths in all Group A, B and C buildings.
3. In all Group E buildings occupied wholly or in part as a planing mill, box factory, wood working establishment where lumber is made into a finished product and in which more than two power operated wood working machines exclusive of saws are used.
4. In all Group E buildings occupied wholly or in part as a mattress factory used to manufacture, assemble or renovate mattresses or stuffed furniture using cotton, silk floss, mohair or other like material for packing or stuffing.

5. In all Group E buildings used as film exchanges.

Exception: The above provisions shall not apply in the following places:

1. Automatic sprinklers shall not be required in the cellars of dwellings and/or apartment houses having four or less apartments, nor in the cellars of Group C, D, E, F, G and H buildings when the ceiling of such cellar or basement is three (3) feet or more above grade, nor when such cellars or basements have an area of fifteen hundred (1500) square feet or less.
2. The alarm valve required for a standard automatic sprinkler system shall not be required in the cellars of Group C, D, E, F, G and H buildings when the area of such cellar is less than three thousand (3000) square feet.

**Automatic  
Sprinkler  
Require-  
ments**

**Sec. 3802.** Every automatic spinkler system required by this Code shall comply in all respects with the regulations of the National Board of Fire Underwriters governing the installation of automatic sprinkler equipment, edition of 1925, where not contrary to the specific statements in this Chapter.

Exceptions: A single water supply equal to the primary supply required by such regulations may be accepted as complying with the requirements of this Code. In no case where a connection to a city water main constitutes the source of supply shall such connection be less than four (4) inches in diameter.

**Dry Stand-  
pipes; Where  
Required**

**Sec. 3803.** Every building three (3) or more stories in height shall be equipped with one (1) or more dry standpipes.

**Dry  
Standpipe  
Require-  
ments**

**Sec. 3804.** Construction. Dry standpipes shall be of wrought iron or galvanized steel and together with fittings and connections shall be of sufficient strength to withstand three hundred (300) pounds of water

pressure to the square inch when ready for service, without leaking at the joints, valves or fittings.

**Size.** Dry standpipes shall not be less than four (4) inches in diameter for buildings five stories or less in height, five (5) inches in diameter for building six to ten stories inclusive in height and six (6) inches in diameter for all buildings more than ten stories in height.

**Number Required.** Every building three or more stories in height where the area of any floor above the second floor is ten thousand (10,000) square feet or less shall be equipped with not less than one (1) dry standpipe and an additional standpipe shall be installed for each additional ten thousand (10,000) square feet or fractional part thereof.

**Location.** Standpipes shall be located within stairway enclosures or as near such stairways as possible or shall be on the outside of, embedded within, or immediately inside of an exterior wall and within one (1) foot of an opening in a stairway enclosure or the balcony or vestibule of a smoke-proof tower or an outside exit stairway.

**Siamese Connections.** All four (4) inch dry standpipes shall be equipped with a two-way Siamese fire department connection. All five (5) inch dry standpipes shall be equipped with a three-way Siamese fire department connection and all six (6) inch dry standpipes shall be equipped with a four (4) way Siamese fire department connection. All siamese inlet connections shall be located on a street front of the building and not less than one (1) foot nor more than four (4) feet above the grade and shall be equipped with clapper-checks and substantial plugs. All Siamese inlet connections shall be recessed in the wall or otherwise substantially protected.

**Outlets.** All dry standpipes shall extend from the ground floor to and over the roof and shall be equipped with a two and one-half (2 1/2) inch outlet not more than four (4) feet above the floor level at each story. All dry standpipes shall be equipped with a two-way two and one-half (2 1/2) inch outlet above the roof. All outlets shall be equipped with gatevalves with substantial chains.

**Threads.** All hose in connection with such standpipe installations shall be uniform with that used by the local fire department.

**Signs.** An iron or bronze sign with raised letters at least one (1) inch in height shall be rigidly attached to the building adjacent to all Siamese connections and such sign shall read: "CONNECTION TO DRY STANDPIPE."

**Sec. 3805.** Every Group A, B and C building of any height and every Group. D, E, F, G and H building three (3) or more stories in height shall be equipped with one (1) or more interior wet standpipes extending from the cellar or basement into the topmost story.

**Wet  
Standpipes;  
Where  
Required**

**Sec. 3806.** Construction. Interior wet standpipes shall be constructed as required for dry standpipes.

**Wet  
Standpipe  
Require-  
ments**

**Size.** Interior wet standpipes shall have an internal diameter of not less than four (4) inches.

**Exceptions:** Interior wet standpipes for Group A, B and C buildings two stories or less in height may be reduced to a three (3) inch internal diameter.

**Number Required.** Wet standpipes shall be so located that any portion of the building can be reached therefrom with a hose not exceeding seventy-five (75) feet in length.

**Location.** The location of all interior wet standpipes shall be approved by the Building Inspector.

**Siamese Connections.** All interior wet standpipes shall be equipped with a Siamese fire department inlet connection located on the street front of the building and such connection shall have two (2) inlets for buildings five (5) stories or less in height, three (3) inlets for buildings six (6) to ten (10) stories inclusive in height, and four (4) inlets for buildings more than ten (10) stories in height.

**Exceptions:** Interior wet standpipes in Group A, B and C buildings two stories or less in height need not be equipped with such Siamese connections.

**Outlets.** All interior wet standpipes shall be equipped with a two and one-half (2-1/2) inch straightway composition gatevalve in each story including the basement or cellar of the building and located not less than one (1) foot nor more than five (5) feet above the floor. Gatevalves shall be equipped with a reducing fitting reducing from two and one-half (2-1/2) inches to one and one-half (1-1/2) inches.

**Threads.** All hose threads in connection with the installation of such standpipes, including valves and reducing fittings, shall be uniform with that used by the local fire department.

**Signs.** An iron or bronze sign with raised letters at least one (1) inch in height shall be rigidly attached to the building adjacent to all Siamese connections and shall read: "CONNECTION TO WET STANDPIPE."

**Water Supplies.** All interior wet standpipes shall be connected to a street water main of not less than four (4) inches in diameter or when the water pressure is insufficient to maintain twenty-five (25) pounds pressure at the highest hose outlet such standpipe shall be connected to a pressure tank, gravity tank or fire pump. Such supply shall be sufficient to furnish at least twenty-five (25) pounds pressure at the topmost hose outlet.

When more than one interior wet standpipe is required in the building, such standpipes shall be connected at their bases or at their tops by pipes of equal size. All supply mains shall be equipped with gatevalves and straightway check valves located adjacent to the source of supply.

**Pressure and Gravity Tanks.** Tanks shall have a capacity sufficient to furnish at least two hundred and fifty (250) gallons per minute for a period of not less than twenty (20) minutes. Such tanks shall be located so as to provide not less than twenty-five (25) pounds pressure at the topmost hose outlet for its entire supply. Discharge pipes from pressure tanks shall extend two (2) inches into and above the bottom of such tanks. All tanks shall be equipped with a manhole, ladder and platform, drain pipe, water and pressure gauges. Every pressure tank shall be tested in place after installation and proved tight at a hydrostatic pressure fifty (50) per cent in excess of the working pressure required. Where such tanks are used for domestic purposes the supply pipe for such purposes shall be located at or above the center line of such tanks. Incombustible supports shall be provided for all such supply tanks and not less than a three (3) foot clearance shall be maintained between the top and bottom of all pressure tanks.

**Fire Pumps.** Fire pumps shall have a capacity of not less than two hundred fifty (250) gallons per minute with a pressure of not less than twenty-five (25) pounds at the topmost hose outlet. The source of supply for such pumps shall be a street water main of not less than four (4) inch diameter or a well or cistern containing a one (1) hour supply. Such pumps shall be supplied with an adequate source of power and shall be automatic in operation.

**Hose and Hose Reels.** Each hose outlet of all interior wet standpipes shall be supplied with a hose not less than one and one-half (1-1/2) inches in diameter. Such hose shall be equipped with a suitable brass or bronze nozzle and shall be not over seventy-five (75) feet in length. An approved standard form of wall hose reel or rack shall be provided for the hose and shall be located so as to make the hose readily accessible at all times and shall be recessed in the walls or protected by suitable cabinets.

**Sec. 3807.** Basement pipe inlets shall be installed in the first floor of every store, warehouse or factory where there are cellars or basements under same, except where in such cellar or basements there is installed an automatic sprinkler system as specified by this Code, or where the cellars or basements are used for banking purposes, safe deposit vaults or similar uses.

**Basement  
Pipe  
Inlets**

All basement pipe inlets shall be of cast iron, steel, brass or bronze with lids of cast brass or bronze and shall consist of a sleeve not less than eight (8) inches in diameter through the floor extending to and flush with the ceiling below and with a top flange, recessed with an inside shoulder, to receive the lid and flush with the finish floor surface. The lid shall be a solid casting and have a ring lift recessed in the top thereof, so as to be flush. The lid shall have the words "Fire Department Only." "Do Not Cover Up," cast in the top thereof. The lid shall be installed in such a manner as to readily permit its removal from the inlet.

The location of such basement pipe inlets shall be approved by the Building Inspector and shall be kept readily accessible at all times to the Fire Department.

## CHAPTER 39—STAGE VENTILATORS

### Stage Venti- lators

**Sec. 3901.** There shall be one or more ventilators constructed of metal of other incombustible material near the center and above the highest part of the stage of every theatre, raised above the stage roof and having a total ventilating area equal to at least ten (10) per cent of floor area within the stage walls. The entire equipment shall conform to the following requirements or their equivalent.

(1) Doors shall open by force or gravity sufficient to overcome the effects of neglect, rust, dirt, frost, snow or expansion by heat or warping of the framework.

(2) Glass, if used in ventilators, must be protected against falling on the stage. A wire screen, if used under the glass, must be so placed that if clogged it cannot reduce the required ventilating area or interfere with the operating mechanism or obstruct the distribution of water from the automatic sprinklers.

(3) The doors and other covers shall be arranged to open instantly after the outbreak of fire, by the use of approved automatic fusible links which will fuse and separate at not more than one hundred and sixty (160) degrees Fahrenheit. A manual control must also be provided by a cord running down to the stage at a point on each side of the stage designated by the Building Inspector.

(4) The fusible link and the cord must hold the doors closed against a force of at least thirty (30) pounds excess counter weight tending to open the door. The fusible links shall be placed in the ventilator above the roof line and in at least two other points in each controlling cord and so located as not to be affected by the sprinkler heads above. Each stage ventilator shall be operated to an open and closed position at least once before each performance.

**CHAPTER 40—MOTION PICTURE MACHINE BOOTHS**

**Sec. 4001.** Every motion picture machine using inflammable films, together with all electrical devices, rheostats, sewing machines and all films present in any Group A, B or C building, shall be enclosed in a booth large enough to permit the operator to walk freely on either side or in back of the machine and shall be not less than seven (7) feet high and have a floor area of not less than fifty (50) square feet to each motion picture machine in such booth.

**Motion  
Picture  
Machine  
Booths**

The floor of such booth shall be constructed of masonry or reinforced concrete or shall be covered with not less than two (2) inches of masonry. The walls and ceiling shall be of not less than one-hour fire-resistive construction as specified in Chapter 43.

The entrance to booth shall be equipped with a tight fitting self-closing fire door of Types 4, 5 or 6 as specified in Section 4304. Such door shall open outwardly and shall not be equipped with any latch. There shall be not more than eight (8) openings for operating machines and for observation, and each opening shall be not more than eighty (80) square inches in area. Each such opening, together with any fresh air inlets, shall be provided with a shutter of not less than fourteen (14) U.S. gauge sheet metal large enough to overlap at least one (1) inch on all sides of such opening and arranged to slide without binding and with the joint between the shutter and the wall to be smoke tight when shutter is down. These shutters shall be held normally open by means of a fine combustible cord fastened to a one hundred and sixty (160) degrees Fahrenheit fusible link (pieces of film shall not be used in place of fusible links), the whole so arranged that the shutters may be easily released and closed either by hand or automatically when released by the fusible link and shall be so designed as to effect a weight of not less than eight (8) pounds on each fusible link.

Every booth shall be equipped with a ventilating inlet not less than thirty (30) square inches in area placed near the floor on each of three sides and protected by wire netting. At the top of every booth there shall be at least a ten (10) inch diameter vent for each motion picture machine. Such vent shall be constructed of sheet metal not less than twenty-four (24) U.S. gauge and shall connect into a masonry flue or go directly through the roof and twelve (12) inches above, and shall be provided with an exhaust fan which will produce a complete change of air in the booth every ten (10) minutes. No wood or other combustible material shall be allowed to come within four (4) inches of the vent. There shall be not more than one elbow or change in direction of this metal vent in any attic space. No such vent shall pass through any occupied room unless encased in not less than four (4) inches of solid masonry.

All shelves, furniture and fixtures within the booth shall be constructed of metal or other incombustible material. Every motion picture machine shall be securely fastened to the floor to prevent overturning.



**Sec. 4001**

All films not in actual use shall be stored in metal cabinets or boxes constructed of galvanized iron or steel with metal partitions and shelves. Each such compartment shall not have a capacity in excess of ten (10) reels of film, and shall have tight self-closing doors of iron or steel. No solder shall be used in the construction of such metal boxes or cabinets.

**CHAPTER 41—PROSCENIUM CURTAINS**

**Sec. 4101.** Proscenium curtains shall be made of incombustible materials constructed and mounted so as to intercept hot gasses, flame and smoke and to prevent glow from a severe fire on the stage showing on the auditorium side within a period of fifteen (15) minutes. The curtain shall be raised and lowered at least once before every performance and shall be lowered each evening at the close of the performance. The closing of the curtain from the full open position shall be effected in less than one (1) minute, but the last five (5) feet of travel shall require not less than five (5) seconds.

**Proscenium  
Curtains:  
General  
Require-  
ments**

**Sec. 4102.** The curtain shall be of not less fire-resistive qualities than as specified in this Section for a Class A Metal Curtain or a Class B Asbestos Cloth Curtain.

**Curtain  
Cover-  
ings**

**Class A Metal Curtain.** The metal curtain shall have its front or auditorium side covered with well fitted metal plates. The stage side shall be covered with insulating boards made of asbestos. Such insulating boards, if of asbestos, shall be at least three-eighths ( $\frac{3}{8}$ ) of an inch thick and weigh not less than two (2) pounds per square foot if solid, or not less than three-fourths ( $\frac{3}{4}$ ) of an inch thick and weigh not less than one and three-fourths ( $1\frac{3}{4}$ ) pounds per square foot if of cellular construction. Other materials which have been proven the equivalent of the above specified asbestos boards in strength, fire resistance and insulating properties may be used in lieu thereof. The covering materials shall be firmly attached to the curtain frame and all joints and linings thoroughly cemented with a fire-resistive or furnace cement.

**Class B. Asbestos Cloth curtain.** The asbestos cloth curtain shall have its framework covered on both sides with a metal reinforced close woven asbestos cloth, weighing not less than three and one-fourth ( $3\frac{1}{4}$ ) pounds per square yard. Marginal members of the frame shall have the cloth covering extended around them to form insulation of at least two thicknesses, or shall have other equivalent insulation.

The covering cloth shall have incorporated into the yarn before weaving, either monel metal, nickel, brass or other metal or alloy having not less strength at a temperature of seventeen hundred (1700) degrees Fahrenheit and not less resistance to corrosion at ordinary temperatures. Asbestos cloth made of long fiber blue crocidolite asbestos may be used in place of chrysotile asbestos cloth of the same weight having wire reinforcement. The wires shall be either single or double but the tensile strength of wires in each strand of yarn shall be sufficient to support a load of not less than seven (7) pounds at ordinary temperatures, and the strength of the yarn with the wires shall be sufficient to support a load of twelve (12) pounds. The strength of the cloth in tension shall be not less than one hundred and eighty (180) pounds per inch of width of warp and eighty-five (85) pounds per inch of filling. The asbestos fiber of yarns may contain cotton or other combustible fiber not in excess of four (4) per cent of the weight of the

asbestos. The total carbon content of the cloth shall not exceed two and one-half ( $2\frac{1}{2}$ ) per cent of the total weight of the fiber. When required by the Building Inspector, a sample of cloth of sufficient size for testing shall be submitted.

The seams of the cloth shall have double rows of stitching of asbestos thread having metal wires of the same or greater strength than the yarns of the cloth.

The asbestos cloth curtain shall have the interior framework of tubes, structural shapes, bars or rods of steel with horizontal members spaced not more than eight (8) feet apart and the vertical members not more than twelve (12) feet apart. A positive separation of the curtain cloth on the two sides of not less than two (2) inches shall be provided. After erection the asbestos cloth shall be filled with a mineral paint having a silicate of soda binder, to which may be added casein in the proportion of not more than four (4) parts of casein to ten (10) parts of concentrated solution of sodium silicate. Any other paint which will completely fill the pores of the cloth and which shall be capable of withstanding fire without giving out more smoke than the above shall be permitted. The paint shall be applied hot and brushed well into the cloth so as to make it practically smoke tight.

**Design  
of  
Curtain**

**Sec. 4103.** The curtain shall have a rigid framework of steel or other suitable metal covered in either manner as specified in Section 4102. It shall have sufficient strength to resist a lateral pressure of at least ten (10) pounds per square foot of its area when in the closed position, with a factor of safety of not less than two (2) on the ultimate strength of the construction. The mounting and details shall be such as to insure ready and positive closure of the curtain when subjected to a pressure of five (5) pounds per square foot uniformly distributed over its entire surface.

The design strength of tension members and cloth shall be based on center deflections of not to exceed one-tenth ( $\frac{1}{10}$ ) of the span. In no case shall the maximum deflection cause a permanent set or bend in the curtain structure nor shall it cause the curtain to rub against the wall at the edges of the proscenium opening.

The thickness of the curtain shall in no case be less than one one-hundred-twentieth ( $\frac{1}{120}$ ) of its span. The width and height of the curtain shall be such that it shall overlap the sides and top of the proscenium opening at least nine (9) inches.

Provision shall be made for the expansion of the curtain and guides due to changes in temperature and an allowance of one-sixteenth ( $\frac{1}{16}$ ) inch per foot of length of steel members shall be made for such purpose.

The curtain shall be guided throughout its travel by rigid steel guides. Such guides shall be securely bolted to the proscenium wall and designed to form a stop between the curtain and the wall, so as to prevent smoke and flame from passing around the edges of the curtain. Where the main members carry the stresses for lateral pressure on the curtain as suspension tension members, the guides shall be attached to the building to safely

carry the reactions from these tension members. The top of the curtain shall have a smoke stop fitted to make it as smoke tight as practicable. The bottom of the curtain shall have a yielding pad of incombustible material not less than three (3) inches thick to form a seal against the floor.

**Sec. 4104.** The mechanism and devices for controlling the curtain shall be of simple design and shall be positive in operation. The opening of the curtain may be by hand, hydraulic or electric power. The closing for emergency or for automatic operation shall be the same as for ordinary operation and shall be by gravity obtained by counterbalancing the curtain with counter weights having not less than one (1) pound for each square foot of curtain.

**Operat-  
ing  
Equip-  
ment**

In addition to the regular operating control station which shall be on the stage floor there shall be three emergency control stations, one of which shall be on the stage. At least three quick acting, heat separating, release devices for automatically closing the curtain shall be provided. The location of the emergency control stations and the release devices shall meet with the approval of the Building Inspector.

For hydraulic machines operating the curtain, the water supply shall be taken from an elevated tank or from a suitable accumulator; supply for electric machines shall be fused independently of the house supply. All parts of the the electric power supply shall be enclosed and well protected against fire.

All machines and hoisting gear shall be designed in accordance with the "Safety Code for Elevators, Dumbwaiters and Escalators" published by the American Society of Mechanical Engineers, July, 1925, as such requirements are specified for passenger elevators, machines and cables. Travel limit stops and room for over-travel shall be provided. Lifting cables shall be not less than one-half (1/2) inch in diameter.

**Sec. 4105.** The complete installation of every proscenium curtain shall be subjected to operating tests and any theatre in which such proscenium curtain is placed shall not be opened to public performances until after the proscenium curtain has been accepted and approved by the Building Inspector.

**Tests**

**Sec. 4106.** Curtains of other designs and materials than specified in this Chapter shall before acceptance be subjected to the standard fire test specified in Chapter 42 as applicable to non-bearing partitions, except that such test shall be continued only for a period of fifteen (15) minutes unless failure shall have occurred previously, and that the average temperature on the unexposed side of the test curtain shall not exceed two hundred and sixty (260) degrees Centigrade at ten (10) minutes nor three hundred and seventy-one (371) degrees Centigrade at fifteen (15) minutes after such test has been commenced. Also the unexposed face of the curtain shall not flow within the test period of fifteen (15) minutes nor shall there be any passage of smoke or flame through the curtain.

**New  
Designs**

**PART VIII**  
**FIRE-RESISTIVE STANDARDS FOR**  
**FIRE PROTECTION**  
**CHAPTER 42—GENERAL**

**Fire-Resistive Construction Defined**

**Sec. 4201.** Building materials, systems, units and forms of construction as regulated by this Code shall be classified as “four-hour fire-resistive construction,” “three-hour fire-resistive construction,” “two-hour fire-resistive construction” and “one-hour fire-resistive construction,” for fire-resistive purposes and protection. Materials, systems, units and forms of construction, in order to be classed as four-hour, three-hour, two-hour or one-hour fire-resistive construction shall meet the respective requirements for such rating as specified in the Tentative Specifications for Fire Tests of Building Construction and Materials, Serial Designation C19-26 T, of the American Society for Testing Materials.

Any materials, systems, units or forms of construction which meet the requirements of the aforesaid Tentative Specifications shall be accepted as fire-resistive construction of the degree specified, if and when they shall be shown by an authoritative test conducted in accordance with all of the provisions of such aforesaid specifications, to possess such fire resistance.

**Fire-Resistive Materials**

**Sec. 4202.** The following materials, combinations of materials systems and units shall be classed as fire-resistive materials:

- Brick
- Concrete brick, block or tile
- Gypsum block or tile
- Gypsum (plain or reinforced)
- Gypsum plaster lath and plaster
- Hollow clay tile
- Metal
- Metal and asbestos
- Metal lath and plaster
- Portland cement concrete (plain or reinforced)
- Sand-lime brick

**Fire-Resistive Construction**

**Sec. 4203.** All fire-resistive construction of burned clay, concrete or gypsum units or other similar units shall be solidly bedded and laid in gypsum mortar, lime-cement mortar or cement mortar; provided, that gypsum units shall be laid in gypsum mortar only. All such units shall be thoroughly bonded together by broken joints in alternate courses or by sufficient metal ties or bonds.

All concrete, gunite, gypsum or similar protection for steel or iron structural members which is cast, poured or similarly applied shall be reinforced at the edges of such members in a sufficient manner to prevent cracking and disintegrating of such protection. All such applied fire protec-

tion materials shall be reinforced by metal rods, wire or mesh to provide against cracking and disintegrating of the protecting material.

All plaster fire protection shall consist of gypsum mortar, Portland cement mortar or other equally fire-resistive material. Gypsum plaster only shall be used for plastering on gypsum units. Wherever plaster is used for fire protection purposes it shall be reinforced with a metal mesh or lath; provided, that where such plastering is placed on masonry or reinforced concrete such reinforcing may be omitted when the plastering is not more than one (1) inch thick. Guniting applied to masonry need not be reinforced and when properly bonded shall be considered a part of the required thickness.

**CHAPTER 43—FIRE-RESISTIVE STANDARDS**

**Protection of  
Structural  
Parts**

**Sec. 4301.** The thickness of fire-resistive materials for fire protection of structural parts shall be as shown in the following table for the respective degrees of fire protection shown. The figures shown shall be the net thickness of the protecting materials and shall not include any hollow space or spaces. The thickness of plaster protection shall be measured from the face of the plaster to the plane of the back surface of the metal or wire lath where such lath is used and shall include two-thirds ( $\frac{2}{3}$ ) of the thickness of the gypsum plaster board where such lath is used.

**Minimum Protection of Structural Parts Based on Time Periods for Various  
Incombustible Insulating Materials**

Structural Parts to Be Protected	Insulating Material Used	Minimum Thickness of Material in Inches for the Following Fire-Resistive Periods			
		4 hr.	3 hr.	2 hr.	1 hr.
Steel or Cast Iron Columns; Projecting Steel Beam and Girder Flanges; Top and Bottom Cords and All Primary Truss Members	Grade A Concrete	3	2	1½	1
	Grade B Concrete	4	3	2	1½
	Gunitite	2½	1½	1	¾
	Brick of Clay, Shale, Concrete or Sand-Lime	4	4	2½	2½
	Clay Tile, or Clay Tile and Concrete	4	3	2	1½
	Solid Gypsum Blocks	4	3	2	1½
	Metal Lath and Gypsum or Portland Cement Plaster	3	2½	2	1
Webs of Steel Beams and Girders	Grade A Concrete	2½	1½	1	1
	Grade B Concrete	3½	2½	1½	1
	Gunitite	2	1	¾	¾
	Brick of Clay, Shale, Concrete or Sand-Lime	4	2½	2½	2½
	Clay Tile, or Clay Tile and Concrete	3	2	1½	¾
	Solid Gypsum Blocks	3	2	1½	1
	Metal Lath and Gypsum or Portland Cement Plaster	2½	2	1½	¾
Reinforced Concrete Columns, and the Soffits of Beams and Girders	Grade A Concrete	2	1½	1	¾
	Grade B Concrete	2½	2	1½	1
Soffits of Joists, and Sides of Beams, and Girders of Reinforced Concrete	Grade A Concrete	1½	1	¾	¾
	Grade B Concrete	2	1½	1	¾
Flat Ceiling Protection of Steel Joists, and Roof Beams where incombustible slab not less than 2" thick is placed above; and protection for secondary truss members	Metal or Wire Lath and Gypsum or Cement Plaster, Concrete, Burned Clay Products or Gypsum	2	1½	1	¾
	Gunitite	1½	1	¾	¾
Reinforcement and Tie rods in Floor and Roof Slabs	Grade A Concrete	1	1	¾	¾
	Grade B Concrete	1¼	1	1	¾
	Gypsum	1¼	1	1	¾
Wood Joisted Floor with Double Board Floor on Top of Joists	Metal or Wire Lath and Gypsum or Portland Cement Plaster	.....	.....	.....	¾



NOTE:

Grade A concrete shall mean concrete with a coarse aggregate of limestone, pumice, calcareous pebbles or trap rock.

Grade B concrete shall mean concrete with a coarse aggregate of granite, sandstone, chert pebbles or quartz.

For flat ceilings where the ceiling protection for beams, girders or slabs is suspended to form a free air space between the member and the protection, the protection thicknesses may be one-half ( $\frac{1}{2}$ ) inch less than that required in above table for flat ceiling protection, but no thickness shall be less than three-fourths ( $\frac{3}{4}$ ) of an inch.

Soffit tile protecting beam and girder flanges shall be tied to the flange with steel or iron ties.

If the structural part is of iron or steel the thickness given in the foregoing table shall be measured outside of the extreme edges of the structural shapes, except that projecting edges of lugs and brackets shall be given a minimum protection of one (1) inch thickness. For reinforced concrete members, the thickness given in the foregoing table shall be outside of the reinforcement. For purposes of design the protection shall not be considered as carrying load except as permitted for tied columns in Section 2621.

Plaster protections of over one (1) inch in thickness shall have an additional layer of metal lath, wire or metal mesh embedded not more than three-fourths ( $\frac{3}{4}$ ) of an inch from the surface and securely tied into the supporting members.

Wire of not less than number ten (No. 10) B. and S. gauge wound or tied around members at not more than a six (6) inch pitch, or wire or expanded metal mesh shall be placed and well embedded in all concrete and gunite protections.

Wire mesh or other forms of metal ties in concrete protections shall be held away from the structural members and embedded in the protection not less than three-fourths ( $\frac{3}{4}$ ) of an inch from its outer surface at points of minimum thickness. Hollow tile or gypsum block protections shall have iron or steel ties embedded in each horizontal joint, or have outside iron or steel ties over each unit, the diameter of wire to be 0.18 inch, or of equivalent area in ties of other forms. Wire mesh, where used for tying protections, shall weigh not less than one and one-half ( $1\frac{1}{2}$ ) pounds per square yard. Where metal lath or wire mesh is used as a plaster base or tie it shall weigh not less than two and two-tenths (2.2) pounds per square yard, and two and one-half or more meshes per inch or equivalent. Gypsum plaster board not less than three-eighths ( $\frac{3}{8}$ ) of an inch thick and having not more than fifteen (15) per cent combustible material combined with the gypsum may be substituted for metal lath for resistance periods of not more than two (2) hours, provided the plaster is reinforced with metal or wire mesh weighing not less than one and one-half ( $1\frac{1}{2}$ ) pounds per square yard, standing away from the board and secured to the supporting members, and two-thirds ( $\frac{2}{3}$ ) of the thickness of the plaster board may be considered as plaster.

Concrete aggregates whose mineral composition is unknown or undetermined shall for the application of these regulations be classed as Grade B aggregates.

**Fire Re-  
sistive  
Walls and  
Parti-  
tions**

**Sec. 4302.** Fire-resistive bearing and non-bearing walls and partitions shall be of not less than the thicknesses and construction specified in this Section, to be classed for the respective degrees of protection indicated.

The structural requirements of the following masonry and reinforced concrete walls are specified in Chapters 24 and 29 for the specified location or use of the walls and walls shall comply with those structural requirements as well as the fire-resistive limitations as specified in this Section.

The following tabulated thicknesses are minimum and shall not be broken into; provided that where combustible floor or partition members project into solid masonry or reinforced concrete walls or partitions the required effective thickness of wall shall be measured from two (2) inches back along the member from the end in the wall, to the opposite face of the wall. Where such members project into hollow walls the space between the members and for not less than four (4) inches above and below them shall be filled solid with fire-resistive incombustible materials for the full thickness of the wall and the required effective thickness shall be measured as specified for solid masonry walls in this paragraph. Where the hollow spaces are not thus filled the required effective thickness of wall shall be measured from the end of the member in the wall to the opposite face of the wall.

Plaster, in order that it may be considered as adding to the fire resistance of walls and partitions shall be gypsum or Portland cement plaster applied to an average thickness or not less than one-half ( $\frac{1}{2}$ ) of an inch on each side. Plaster over one (1) inch in thickness, as measured to the plaster base, shall have an additional layer of metal lath, wire or metal mesh embedded not more than three-fourths ( $\frac{3}{4}$ ) of an inch from the surface and securely tied into the supporting members.

Gypsum plaster board not less than three-eighths ( $\frac{3}{8}$ ) of an inch in thickness and having not more than fifteen (15) per cent of combustible material combined with the gypsum may be substituted for metal lath for resistance periods of not more than two (2) hours, provided the plaster is reinforced with metal or wire mesh weighing not less than one and one-half pounds per square yard, standing away from the board and secured to the supporting studs or joists. Two-thirds of the thickness of the plaster board may be considered as plaster.

Metal or wire lath shall weigh not less than two and two-tenths (2.2) pounds per square yard. Metal or wire mesh where used as ties in concrete shall weigh not less than one and one-half ( $1\frac{1}{2}$ ) pounds per square yard. Where used as ties for plaster it shall weigh not less than two and two-tenths (2.2) pounds per square yard and have not less than two and one-half meshes per inch, or equivalent.

Wood studs for bearing partitions or walls shall be not less than the two inch by four inch ( $2" \times 4"$ ) nominal size and be spaced not more than sixteen (16) inches apart.

Note: The term "plastered" in following table shall mean walls plastered with not less than one-half ( $\frac{1}{2}$ ) inch of gypsum or Portland cement plaster on each side of wall.

Rated Fire Resistance Periods for Various Walls and Partitions

Material	Construction	Minimum Finished Thickness, face to face (including plaster where mentioned) in inches			
		4 hr.	3 hr.	2 hr.	1 hr.
Brick of Clay, Shale Sand-Lime or Con- crete	Solid unplastered	8	8	8	4*
	Solid plastered	9	9	5*	5*
	Hollow (rowlock) unplastered	12	12	8	8
	Hollow (rowlock) plastered	9	9	9	9
Clay Hollow Tile Wall	End or side construction. One cell in wall thickness. Plastered.	....	....	7	4* or 5*
	End or side construction. Two cells in 8-inch or 6-inch thickness. Unplastered	16	12	10	6* or 8
	End or side construction. Two cells in 8-inch or 6-inch thickness. Plastered	13	13	7* or 9	5*
	End or side construction. Three cells in 8-inch thick- ness. Unplastered.	12	12	8	7* or 8
	End or side construction. Three cells in 8-inch thick- ness. Plastered	13	9	9	9
Grade A Hollow Concrete Blocks	One cell in 8-inch or less thickness. Unplastered.	10	8	6	4*
	One cell in 8-inch or less thickness. Plastered.	9	7	5*	....
Grade B Hollow Concrete Blocks	One cell in 8-inch or less thickness. Unplastered	12	10	8	6* or 8
	One cell in 8-inch or less thickness. Plastered	11	9	7* or 9	7* or 9
Solid Concrete	Reinforcement not less than 2% in each direction.	6	4*	3*	2*
Solid Gunite		5*	3 1/2*	2 1/2*	1 1/2*
Hollow Gypsum Blocks	Plastered or unplastered	6*	5*	4*	3*
Hollow Gunite Wall	Hollow walls of reinforced gunite. Outer shell 2" thick for 10-inch wall and 1 1/2" thick for 8-inch wall.	10	8	....	....
Solid Gypsum or Portland cement Plaster	Incombustible studding with metal or wire lath	....	....	3*	2*
Hollow partition with 3/4-inch gyp- sum or Portland cement plaster or gunite on each side	Incombustible studding with metal or wire lath. Not less than 1-inch plaster on each side for 2-hour rating.	....	....	4 1/2*	3*
	Wood studs with metal or wire lath. Fire stopped.	....	....	....	3* or 5

\*Indicates that such walls and partitions shall be used for non-bearing purposes only.

**Sec. 4303.** Fire-resistive floor construction shall be accepted for the following respective degrees of fire-resistive protection when constructed as specified in this Section. For the structural details of any floor construction, the particular details specified under Part VI of this Code shall govern.

**Fire-Resistive Floor Construction**

Four-hour, three-hour and two-hour fire-resistive floors as specified in this Section shall be constructed entirely of incombustible materials.

(a) Four-hour fire-resistive floor construction shall consist of reinforced concrete and/or solid masonry slabs or arches not less than four (4) inches in thickness or shall be of hollow masonry slabs or arches not less than four (4) inches in thickness with a top covering of not less than two (2) inches of solid masonry. All reinforcing, tie rods and supporting structural members in such floors shall be protected with not less than four-hour fire-resistive construction as specified in Section 4301.

(b) Three-hour fire-resistive floor construction shall consist of reinforced concrete and/or solid masonry slabs or arches not less than three (3) inches in thickness or shall be of hollow masonry slabs or arches not less than four (4) inches in thickness with a top covering of solid masonry not less than one and one-half (1 1/2) inches in thickness. All reinforcing, tie rods and supporting structural members in such floor construction shall be protected with not less than three-hour fire-resistive construction as specified in Section 4301.

(c) Two-hour fire-resistive floor construction shall consist of reinforced concrete and/or solid masonry slabs or arches not less than two and one-half (2 1/2) inches in thickness or shall be of hollow masonry slabs or arches not less than three (3) inches in thickness with a top covering of not less than one (1) inch of solid masonry. All reinforcing, tie rods and supporting structural members in such floor construction shall be protected with not less than two-hour fire-resistive construction as specified in Section 4301.

(d) One-hour fire-resistive floor construction shall consist of reinforced concrete and/or solid masonry slabs or arches not less than two and one-half (2 1/2) inches in thickness or of hollow masonry slabs or arches not less than three (3) inches in thickness with all joints in such hollow unit construction thoroughly filled with cement or gypsum mortar; and with all reinforcing, tie rods and supporting structural members protected with not less than four-hour fire-resistive construction as specified in Section 4301: or

Wood joisted construction with double wood floor (each layer not less than three-fourths (3/4) of an inch in thickness) on top and with a one-hour fire-resistive ceiling as specified in Section 4301 securely fastened to or suspended from the under side of such joists.

**Sec. 4304. (a) Fire-resistive Doors.** One-hour fire-resistive doors shall be constructed as specified for one of the following types, 1, 2 or 3, or any door which will successfully pass the one-hour fire test specified in Section 4201, and all such doors to receive the one-hour rating, shall be hung in place as specified in this Section:

**Fire Doors, Shutters and Windows**

1. Tin-clad wood-core doors with the core made of three (3) plies of wood one (1) inch nominal in thickness and covered with sheet metal, the door to be constructed in accordance with the "Underwriters' Standard for Tin-Clad Fire Doors and Shutters," Edition of March, 1926;

2. Sheet metal doors constructed of two (2) sheets of not less than twenty-six (26) U.S. Gauge corrugated sheet metal, one sheet on each side of a structural steel frame, corrugations vertical on one side and horizontal on the other and having not less than one-sixteenth ( $1/16$ ) of an inch of asbestos placed in between the two metal sheets;

3. Sheet metal doors constructed of two (2) sheets of metal of not less than twenty-six (26) U.S. Gauge fastened to a structural steel frame in such manner as to leave a one (1) inch space in the panels, which space shall be filled with asbestos and with a one-eighth ( $1/8$ ) inch asbestos covering on the stiles and structural steel frame;

provided, that where used for openings in stairway enclosures, smoke-proof towers, corridors and passageways, moving picture booths, room partitions, exterior walls facing streets or more than twenty-five (25) feet from adjacent property lines and for "Ordinary Fire Separations" as specified in Section 503, doors constructed as specified for one of the following types, 4, 5 or 6 or any door which will provide equivalent protection against fire when hung in place as specified in this Section:

4. Tin-clad wood-core doors made of two (2) plies of wood one (1) inch nominal in thickness and covered with sheet metal, the door to be constructed in accordance with the "Underwriters' Standard for Tin-Clad Fire Doors and Shutters," Edition of March, 1926;

5. Hollow metal doors as specified in paragraph 3 above, but with one-fourth ( $1/4$ ) of an inch of asbestos placed between the metal sheets in the panels and with no asbestos required on the stiles and structural frame;

6. Metal-clad doors which shall be wood panel doors with frame not less than one and three-fourths ( $1\frac{3}{4}$ ) inches in thickness and with wood panels not less than three-fourths ( $3/4$ ) of an inch in thickness, the whole door covered with not less than number twenty-six (No. 26) gauge metal. The panels of such doors shall fit into the frame not less than three-fourths ( $3/4$ ) of an inch and all joints of metal shall be lapped and nailed tightly to the wood frame.

Metal shall in all cases be fastened to the wood or metal frame by nailing, bolting or riveting and no solder shall be used on any door except for filling of joints.

Glass panels shall be permitted in any of the above doors except when such doors are used on openings in fire walls, fire division walls, all openings for the stage portion of any Group A building or for openings in "Special Fire Separations" as specified in Section 503. Such glass panels shall be not more than seven hundred and twenty (720) square inches, in area nor exceed fifty-four (54) inches in height or forty-eight (48) inches in width. Grooves not less than three-fourths ( $3/4$ ) of an inch in depth and

three-eighths (3-8) of an inch wide providing not less than five-eighths ( $\frac{5}{8}$ ) of an inch of bearing for the glass shall be required.

Fire doors bearing the label of the Underwriters' Laboratories, Incorporated, shall be accepted as meeting the requirements of any of the above doors when constructed in accordance with the requirements of this Section.

Hardware for sheet metal and tin-clad fire doors shall be made of good quality malleable iron not less than one-fourth ( $\frac{1}{4}$ ) of an inch thick or of flat rolled structural steel not less than three-eighths (3-8) of an inch thick; provided, that tubular steel track made of at least one-eighth ( $\frac{1}{8}$ ) inch steel may be used. Sliding tracks shall be supported so that a wall fastening is directly opposite each door hanger when door is in a closed position. Hangers supporting doors shall be fastened to the door with not less than three (3) one and one-half ( $1\frac{1}{2}$ ) inch bolts extending through the door. Latches for fire doors shall be not less than two and one-half ( $2\frac{1}{2}$ ) inches by three-eighths inch ( $2\frac{1}{2}'' \times \frac{3}{8}''$ ), and latch bars shall be not less than one and one-half inches by one-fourth inch ( $1\frac{1}{2}'' \times \frac{1}{4}''$ ).

Fire doors required by this Code shall be installed in the manner prescribed in the "Regulations of the National Board of Fire Underwriters for the Protection of Openings in Walls and Partitions Against Fire," recommended by the National Fire Protection Association, Edition of 1927.

All fire doors shall be so hung that when closed they will fit tightly into place against the wall or frame so as to prove an effective stop for fire and smoke. Space around fire doors necessary for their operation shall at all times be kept unobstructed and when deemed necessary by the Building Inspector a screen or railing protection shall be installed to insure no storing or placing of material against any fire door which would prevent its operation in case of emergency.

(b) **Fire-resistive Shutters.** One-hour fire-resistive shutters shall be constructed as specified for any one of the types of fire-resistive doors specified in part (a) of this Section.

(c) **One-hour Fire-resistive Windows.** One-hour fire-resistive windows shall have frames and sash of solid metal bars or hollow metal forms fabricated by pressing, welding or crimping together but not by the use of solder or other fusible alloy. All glass used in fire-resistive windows shall be not less than one-fourth ( $\frac{1}{4}$ ) of an inch in thickness and no one light shall exceed seven hundred and twenty (720) square inches in area. Grooves three-fourths ( $\frac{3}{4}$ ) of an inch in depth shall be provided and glass so arranged as to have not less than five-eighths ( $\frac{5}{8}$ ) of an inch of bearing in hollow metal frames and with grooves not less than one-half ( $\frac{1}{2}$ ) inch and with glass provided with not less than three-eighths (3-8) of an inch of bearing in windows of solid metal section. Continuous glazing angles shall be provided on the inside. Fire-resistive windows with hollow metal frames shall be limited to a maximum size of sixty (60) square feet with a six (6) foot maximum width and a ten (10) foot maximum height for double

hung and counterbalanced windows and to a maximum size of seventy (70) square feet with a seven (7) foot maximum width and ten (10) foot maximum height for stationary windows. Solid metal section windows shall be limited to a maximum size of eighty-four (84) square feet in area with a maximum dimension in either direction of twelve (12) feet. Multiple section windows of these above sizes may be used when hollow metal or solid section mullions are provided. Hollow metal mullions shall be limited to a maximum length of twelve (12) feet and shall be used for non-bearing purposes only. Solid section mullions when used in lengths exceeding twelve (12) feet shall be fireproofed as required in Section 4301 in accordance with the fire-resistive construction of the building in which they are placed. Where fire-resistive windows are required by this Code, wood sash and plain glass may be substituted when protected as specified in Parts (a) and (b) of this Section.

Fire-resistive windows bearing the label of the Underwriters' Laboratories, Incorporated, certifying that that type has passed the one-hour fire-resistive test as specified in Chapter 42 shall be accepted as one-hour fire-resistive windows.

## Roof Coverings

**Sec. 4305.** Roof coverings for all buildings shall be either "Fire Retardant" or "Ordinary" roofings as specifically required either by Location in Part IV, by Type of Construction in Part V or as specified in Sections 1108 and 1208. The roof covering shall be securely fastened to the supporting roof construction.

(a) **Fire Retardant Roofings.** "Fire Retardant" roofings shall be any roof covering which meets the requirements specified for any one of the following roofings, 1 to 13, inclusive, and shall be any roofing meeting the requirements of the Class A or B specifications of the Underwriters' Laboratories, Incorporated:

1. Not less than two layers of prepared composition roofing, each layer weighing not less than thirty-two (32) pounds to the one-hundred-eight (108) square feet solidly mopped between with asphalt so that in no place shall layer touch layer, and covered with a flood coat of asphalt in which there shall be embedded gravel, crushed brick, stone or other approved incombustible material to completely cover the surface.

2. Not less than four layers of asphalt saturated rag felt, each layer weighing not less than fourteen (14) pounds to the one-hundred (100) square feet solidly mopped between with asphalt so that in no place shall layer touch layer, and covered with a flood coat of asphalt in which there shall be embedded gravel, crushed brick or stone, or other approved incombustible material to completely cover the surface.

3. Not less than two layers of asphalt saturated rag felt, each layer weighing not less than fourteen (14) pounds to the one-hundred (100) square feet (or their equivalent in weight in one or more layers of asphalt saturated rag felt or prepared composition roofing) and either one layer of mineral surfaced prepared composition roofing weighing not less than

eighty-two (82) pounds to the one-hundred-eight (108) square feet or one layer of smooth finished prepared composition roofing weighing not less than seventy-two (72) pounds to the one-hundred-eight (108) square feet. The said layers of felt and/or roofing mopped solidly between with asphalt so that in no place shall layer touch layer.

4. Not less than two layers of asphalt impregnated asbestos roofing felt, the combined total weight of which shall be not less than seventy-four (74) pounds to the one-hundred-eight (108) square feet, mopped solidly between and surfaced with asphalt so that in no place such layer touch layer.

5. Not less than one layer of asphalt saturated rag felt weighing not less than forty-five (45) pounds to the one-hundred-eight (108) square feet over which there shall be laid two layers of asphalt impregnated asbestos roofing felt, each layer weighing not less than fourteen (14) pounds to the one-hundred-eight (108) square feet; or one layer of asphalt saturated prepared roofing weighing not less than ninety (90) pounds to the one-hundred-eight (108) square feet over which there shall be laid not less than one layer of asphalt impregnated asbestos roofing weighing not less than fourteen (14) pounds to the one-hundred-eight (108) square feet. The said layers of roofing and/or felt shall be mopped solidly between and surfaced with asphalt so that in no place shall layer touch layer.

6. Hydraulic compressed rigid shingles not less than one-eighth ( $\frac{1}{8}$ ) inch thick, composed of Portland cement and asbestos fibers, laid over a layer of saturated felt weighing not less than fourteen (14) pounds to the one-hundred (100) square feet; or hydraulic compressed rigid sheets not less than seventy-thirty-seconds ( $\frac{7}{32}$ ) inch thick, composed of Portland cement and asbestos fibers. The aforesaid felt may be omitted when the compressed shingles are placed over an existing roof covering.

7. Asphalt saturated mineral surfaced prepared composition shingles laid so there shall be not less than two thicknesses at all places. The combined weight of such shingles shall not be less than one-hundred-ninety (190) pounds to the one-hundred (100) square feet of completed roof area.

8. Not less than two layers of asphalt saturated rag felt, each layer weighing not less than fourteen (14) pounds to the one-hundred (100) square feet (or their equivalent in weight in one or more layers of asphalt saturated rag felt or prepared composition roofing), and one layer of prepared composition roofing, either smooth finish or sanded on one side and weighing not less than fifty-two (52) pounds to the one-hundred-eight (108) square feet. The said layers of felt and/or roofing mopped solidly between so that in no place shall layer touch layer.

9. One layer of asphalt impregnated asbestos felt (built up at the factory of not less than three (3) plies of asphalt impregnated asbestos felt) and weighing not less than sixty-two (62) pounds to the one-hundred-eight (108) square feet; provided, that such roofing shall not be used on roofs which have a rise of not less than three (3) inches to each twelve (12) inches of horizontal projection.



10. Concrete Slab or Concrete Tile. Concrete slab roofs shall be constructed as specified in Chapter 26 and need not be covered with any additional roof covering.

11. Metal Roof Covering. Metal roof covering may be of a corrugated, standing seam or flat type of not less than number twenty-six (26) U.S. Gauge metal. All flat metal roof coverings shall be laid on solid sheathing. Corrugated or standing seam metal roof covering shall be designed to support the required live load between supporting members.

12. Slate. Each slate shingle shall be securely fastened to the supporting roof construction with copper nails or with copper nails and copper wire, with nails of such length as to provide not less than three-fourths ( $\frac{3}{4}$ ) of an inch of penetration into the nailing strips or sheathing.

13. Clay tile. Clay roof tile shall not absorb more than fifteen (15) per cent of the dry weight of the tile during a forty-eight (48) hour immersion test.

Clay roof tile having a lug projecting from the bottom surface may be laid on roofs not exceeding a two-thirds (2-3) pitch by having such tile hooked over a wood or metal strip the thickness of the projection from the tile and securely fastened to the roof construction; provided, that all such tile at hip, ridges and gables shall be nailed and/or wired as specified in this sub-section 12. The projecting lug shall be not less than five-eighths- ( $\frac{5}{8}$ ) inch thick and shall project from the bottom of the tile not less than one (1) inch.

All clay roof tile without any projection lug shall be nailed and/or wired in place.

Copper nails and copper wire shall be used wherever nailing and wiring of tile is required in this sub-section; provided, that when roofs do not exceed a one-third ( $\frac{1}{3}$ ) pitch galvanized iron nails may be used. Wire shall be not smaller than number fourteen (No. 14) B. and S. gauge. Nails shall in all cases penetrate not less than three-fourths ( $\frac{3}{4}$ ) of an inch after passing through the tile or other fastening device.

(b) **Ordinary Roofings.** "Ordinary" roof coverings shall be any roof covering which meets the requirements specified for the following roof coverings, 14 to 16, inclusive, and shall be any roofing meeting the Class C Specifications of the Underwriters' Laboratories, Incorporated, as of May, 1924.

14. Asphalt saturated mineral surfaced prepared composition roofing weighing not less than eighty-two (82) pounds to the one-hundred-eight (108) square feet or in shingle form cut from the same roofing.

15. Asphalt saturated prepared composition roofing weighing not less than fifty-two (52) pounds to the one-hundred-eight (108) square feet and shall be used on Group J buildings only.

16. Wood shingles used as roof covering shall be of clear vertical grain all-heart wood and shall be not less than five (5) shingles to two (2) inches

in thickness at the butt (U.S. Government Standard) and shall be laid with the following exposures as compared to total length of shingle:

Total Length of Shingle	Permissible Exposed Length
16 in.	5 in.
18 in.	5½ in.
24 in.	7½ in.

All wood shingles shall be nailed firmly with copper, zinc, zinc-coated or commercially pure iron nails of at least twelve and one-half (12½) gauge and not less than one and one-fourth (1¼) inches long. Each shingle shall be nailed with at least two (2) nails driven substantially into the supporting roof construction.

**PART IX**  
**REGULATIONS FOR USE OR OCCUPANCY**  
**OF STREETS AND PROJECTIONS OVER**  
**PUBLIC PROPERTY**

**CHAPTER 44.—TEMPORARY USE OF STREETS DURING**  
**CONSTRUCTION**

**Temporary  
Use of  
Streets  
During  
Construc-  
tion**

**Sec. 4401.** No building material or materials shall be placed upon the streets or sidewalks except as provided in this Chapter.

Building materials required for use immediately or in connection with the construction of a building may be placed upon the street or sidewalk in front of the building in course of construction or alternation. The maximum width of such occupied space shall not exceed one-third ( $\frac{1}{3}$ ) the width of the street, measured between curbs, and in no case shall the space within five (5) feet of the nearest rail of any railway tracks be occupied for building materials. The sidewalk space may be occupied for building construction purposes provided the owner or his agent constructs a temporary sidewalk not less than five (5) feet in width in the outer portion of the permissible occupied space, and such temporary sidewalk shall be protected on the building side by a tight fence not less than eight (8) feet in height.

In Fire Zone No. 1 and when the proposed building exceeds a height of two (2) stories in any part of the city, the owner or his agent shall construct, before any building is commenced, a temporary covered walk-way not less than five (5) feet wide, of sufficient strength to protect the public from falling materials during construction and such covered walk-way shall remain in place until the completion of all of the exterior portions of the building. When the area occupied by the sidewalk or temporary walk-way is to be excavated, such walk shall be made of boards not less than two (2) inches thick, designed to support a load of not less than one hundred and fifty (150) pounds per square foot, provided with suitable ramps at each end, and with hand rails on each side. The roof over such walk-way shall be the full width of the walk-way and of not less than two (2) layers of one (1) inch boards with joints broken, and shall be placed not less than ten (10) feet above the temporary walk-way. Whenever such roof is used for storing of materials a railing and foot board shall be so installed as to prevent the materials from spilling into the street.

Building materials may be placed in front of the property adjoining a building site under the same conditions as provided for the occupation of the street immediately in front of the building site, provided the written consent and waiver of claim for damages against the City of . . . . . is obtained from the owner or owners of such adjoining property, and filed in the office of the Building Inspector.

No building material, fence, shed or any obstruction of any kind shall be placed so as to obstruct free approach to any fire hydrant, lamp post, manhole, fire alarm box, or catch basin, or so as to interfere with the passage of water in the gutter.

Mortar or concrete may be prepared in the space permitted for storage of building materials, but shall be done in a mechanical mixer or in a tight box or on a tight mixing board in such a manner that dripping or splashing is prevented. Pavements shall be well cleaned of all building materials at the completion of the construction of a building.

The covered walk-way shall be kept well lighted continuously between sunset and sunrise and the outer edge of the occupied space of the street or sidewalk shall have placed thereon red lights which shall be kept burning continuously between sunset and sunrise.

The street side of any barricade or fence and hand rails and sidewalks shall be kept reasonably smooth and in good repair while construction work is in progress or while such barricades, fences or walk-ways are placed on or over public property..

**CHAPTER 45—PERMANENT OCCUPANCY OF PUBLIC  
PROPERTY**

**Permanent  
Occupancy  
of Public  
Property**

**Sec. 4501.** No portion of any building whatsoever nor any accessory thereto other than signs as provided in Ordinance No. . . . . shall project over any public street or sidewalk except as specified in this Section.

(a) Unroofed porches, balconies or oriel windows may extend not more than three (3) feet over public streets or sidewalks, but shall in no case be less than ten (10) feet in the clear above the sidewalk or street level immediately below.

(b) Movable awnings of combustible materials supported throughout on metal frames may extend over the sidewalk portion of a public street a distance equal to two-thirds ( $\frac{2}{3}$ ) the width of the sidewalk space; provided, that every such awning frame shall be not less than seven feet and six inches (7'-6") above the sidewalk immediately below and that any fringe attached to such or shall be not less than seven (7) feet from the sidewalk level immediately below.

(c) Cornices constructed of fire-resistive materials if more than ten (10) feet above the sidewalk may project over a public street not more than four (4) feet.

(d) A fixed awning or marquee projecting over the sidewalk shall conform to the following regulations:

(1) Such awning or marquee shall be supported entirely from the building.

(2) All combustible materials used in the construction of any fixed awning or marquee shall be protected by not less than one-hour fire-resistive construction as specified in Chapter 43.

(3) Such awning or marquee shall be at least eight (8) feet in the clear between the lowest point of any projection and the sidewalk immediately below and shall not occupy more than two-thirds ( $\frac{2}{3}$ ) the width of the sidewalk, measured from the building, except that when such awning or marquee is twelve (12) feet in the clear above the sidewalk immediately below, it may extend the full width of the sidewalk for a distance of not more than fifteen (15) feet along the direction of the length of the street.

(4) Every awning or marquee shall be so located as not to interfere with the operation of any exterior standpipes, stairways or exits from the building and such location shall meet with the approval of the Building Inspector.

(5) The roof of any such awning or marquee shall be sloped to downspouts which shall conduct any drainage under the sidewalk to the curb.

(e) Water tables, belt courses, sills, bases, columns, pilasters, capitals or other decorative features shall not project more than six (6) inches beyond any lot line.

(f) No part of any show window, store, front or show case except the sill, as provided in paragraph (e) of this Section, shall project beyond the property line. Doors in Fire Zones No. 1 and 2 shall not project more than one (1) foot beyond the property line bordering a street and shall not project into any alley. Doors in buildings outside of Fire Zones No. 1 and 2 which swing over the street property line shall be maintained normally closed.

(g) The space below the sidewalk level may be used for any purpose not inconsistent with any other requirements of this or other Ordinances, but the occupation of this space may be revoked by the City of ..... at any time, and the owner of the building occupying such space shall be required to pay all costs attendant therewith.

(h) No projection whatsoever shall be allowed in alleys except a curb or buffer block extending not more than nine (9) inches from the face of the building and not more than nine (9) inches above the adjacent alley grade.

**PART X**  
**LEGISLATIVE**  
**CHAPTER 46—LEGISLATIVE**

<b>Validity</b>	<p><b>Sec. 4601.</b>—If any section, sub-section, sentence, clause or phrase of this Ordinance is, for any reason held to be unconstitutional, such decision shall not affect the validity of the remaining portions of this Ordinance. The .....</p> <p>.....</p> <p>hereby declares that it would have passed this Ordinance, and each section, sub-section, clause or phrase thereof, irrespective of the fact that any one of more sections, sub-sections, sentences, clauses and phrases be declared unconstitutional.</p>
<b>Appended Documents</b>	<p><b>Sec. 4602.</b> The specifications, suggested ordinances and regulations which are mentioned by title and date of publication in various parts of this Ordinance are hereby declared to be a part of such Ordinance when not in conflict with a specific statement contained in the body of this Ordinance to the contrary. Copies of such specifications, ordinances and regulations shall be kept on file in the office of the City Clerk and in the office of the Building Inspector as file numbers .....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>(See Appendix for list of above mentioned documents.)</p>
<b>Ordinances Repealed</b>	<p><b>Sec. 4603.</b>—Ordinance No. .... and all ordinances amendatory thereto, and all ordinances or parts of ordinances in conflict with this Ordinance are hereby repealed.</p>
<b>Date Effective</b>	<p><b>Sec. 4604.</b> This Ordinance shall be, and is hereby declared to be in full force and effect, from and after ..... days from its date of final passage and approval.</p>

# APPENDIX

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This Appendix contains suggestions and explanatory matter with reference to various details in the body of the Code but its not to be considered as a legal part of the Code. This data is given to assist in proper operation and use of the Uniform Building Code.

The Conference plans to expand this Appendix in the future with many suggestions of what is good practice in building construction.

**Refer to Sec. 101.** The blank spaces in this section should be filled in by the individual city in adopting the Code with the proper names and titles. There are a number of other places in the Code where similar blank spaces occur which must also be filled in at the time of adopting the Code.

**Refer to Sec. 201.** At the end of this section it will be noted that the signature of the architect, engineer or designer responsible for the preparation of plans submitted for permit is required. Some states require all structural designs to be certificated by a licensed engineer and the proper change should be made at this point so that the Code, when adopted, will not conflict with the state law.

**Refer to Sec. 202.** It is advisable and recommended that the Building Inspector keep in a permanent file the plans for all large buildings, buildings involving complicated designs and buildings designed for future extensions or additions.

**Refer to Sec. 203.** Fees should ordinarily be paid to the Building Inspector when the form of government so permits in order that the building public may be most efficiently served.

**Refer to Sec. 204.** The form of general inspection as suggested in the first part of Section 204 has been found to operate very satisfactorily in many cities. A form of permit card posted on each job should be used to show by whom each successive inspection was made and to record the date of that inspection. General information such as permit number, names of owner and contractor and the location of the job should be included on such inspection card.

Special engineering supervision as provided in this Code is a necessary factor for greatest economy in building construction. It provides the safety necessary to the public where higher working stresses are allowed the various building materials. There is no building department sufficiently manned to properly inspect even the most important buildings and the inspection service required in Section 204 is more than paid for by granting increased working stresses in building materials.

**Refer to Secs. 302, 303, 304.** In order that the Code will not present a closed door to developments in building materials or methods of construction a means is provided in these three sections to permit their use when they are found safe and sufficient for their proposed use.

The Board of Examiners and Appeals serves not only as a board of judgment on new materials and devices but also arbitrates any decision of the Building Inspector in matters affecting interpretations of the Code. It



will be noted that no power is vested in the Board for amending the Code but that amendments must be made by the proper legislative authorities.

Through the provisions of these three sections the Code is given flexibility in operation, which has been found to be necessary in the operation of such a legal document.

The blank space in Section 304 should be filled in with the name of the person or body who is to appoint the Board of Examiners and Appeals.

**Refer to Sec. 1502.** The following suggestions are given as a guide for the detailed design and construction of reviewing stands.

Every reviewing stand shall be constructed with four inch by six inch (4" × 6") girders running parallel to the front of such stand, spaced not more than six (6) feet apart, and supported at distances not exceeding six (6) feet apart by posts of not less than four inches by six inches (4" × 6"). These posts shall be braced diagonally with one inch by six inch (1" × 6") bracing, forming a continuous herringbone bracing, the full length of such stand for each vertical six (6) feet of such posts. The girders at the top of the posts shall be braced with braces not less than four inches by four inches (4" × 4") at right angles to the joists above the girders. Every post or brace shall be thoroughly secured to a foot plate, which shall be of sound wood not less than two inches by six inches (2" × 6") in cross section laid solidly on the ground at right angles to the front of the stand and forming the base for each line of posts. There shall be joists resting on the girders of not less than two inches by eight inches (2" × 8") cross section. Such joists shall be spaced not exceeding forty (40) inches apart and two inch (2") plank shall be used for the seats and steps. Braces shall be provided whenever necessary to make a solid, substantial structure, which shall be safe under any possible emergency. All timbers forming the framing shall be thoroughly spiked together. There shall be a level stringer of two inches by six inches (2" × 6") cross section at the bottom of each line of posts, parallel to the stand; also a horizontal piece of two inches by six inches (2" × 6") cross section the full length of the stand and at right angles to same for every row of posts, and every six (6) feet of vertical height thereof. All timbers used in the construction of reviewing stands shall be sound (no secondhand or broken lumber permitted). Wherever the stand, or a portion thereof, extends over an excavation, the posts shall be extended to the bottom of said excavation and shall be braced with horizontal braces as hereinbefore provided.

**Refer to Sec. 1601.** It is impossible to include the districting requirements for each city so that provision is made in this section to incorporate by reference a separate ordinance outlining the limits of the various fire zones.

The following principles may be utilized in outlining the fire zones.

Fire Zone No. 1 should contain the general retail business portion of the city and the more highly congested areas.

Fire Zone No. 2 should include the area lying immediately beyond and adjacent to Fire Zone No. 1 and extensions of the retail district along main thoroughfares.

By designating the areas along principal crosstown thoroughfares, barriers will be set up for proper protection of the city in the event of a general conflagration.

Fire Zone No. 3 should comprise the general residential areas and all of the territory not included in Fire Zones No. 1, 2 and 4.

Fire Zone No. 4 should include the general commercial and industrial areas.

**Refer to Sec. 1802.** In the event that a zoning ordinance or other special ordinance provides height limits, it will be necessary to note in the ordinance of adoption that such regulations shall not be repealed in adopting this Code. Another means of providing against any possible conflict is to revise Section 1802 so as to include the maximum height limit.

**Refer to Sec. 2301.**

## WEIGHTS OF BUILDING MATERIALS

	Lbs. Per Cu. Ft.
Brick, Pressed .....	150
Brick, Common .....	125
Brick, Common, laid $\frac{3}{8}$ " joints .....	120
Brick, Soft, laid $\frac{3}{8}$ " joints .....	100
Cinders, dry, bituminous, in bulk .....	45
Concrete—	
Cinder, structural .....	110
Stone or gravel .....	144
Concrete Building Tile, 60% solid .....	87
Concrete Building Tile, 55% solid .....	79
Slag (blast furnace) .....	130
Cast Iron .....	450
Earth—	
Common load, dry and loose .....	76
Clay and gravel, dry and loose .....	100
Common earth, dry and packed .....	100
Wet mud .....	120
Glass .....	157
Granite .....	170
Gravel, dry .....	120
Granite Masonry, dressed .....	165
Granite Masonry, rubble .....	155
Limestone Masonry, dressed .....	162
Marble Masonry, dressed .....	170
Mortar, hard, cement .....	135
Mortar, hard, lime .....	105
	Lbs. Per Sq. Ft.
Partitions—	
2" × 4" studs, wood lath, $\frac{5}{8}$ " plaster, both sides .....	16
2" × 4" studs, plaster board, $\frac{5}{8}$ " plaster, both sides .....	16
Channel studs, metal lath, cement plaster, solid 2" thick .....	20
Plaster on hollow clay tile (one side) .....	5
2" Hollow Clay Tile .....	13
3" Hollow Clay Tile .....	16
4" Hollow Clay Tile .....	18
5" Hollow Clay Tile .....	20
6" Hollow Clay Tile .....	25
8" Hollow Clay Tile .....	30
12" Hollow Clay Tile .....	45
Plaster on plaster block partitions (one side) .....	5
2" Plaster Blocks .....	7

2 1/2" Plaster Blocks . . . . .	8.5
3" Plaster Blocks . . . . .	9.5
3 1/2" Plaster Blocks . . . . .	10.5
4" Plaster Blocks . . . . .	12
5" Plaster Blocks . . . . .	15
6" Plaster Blocks . . . . .	18
8" Plaster Blocks . . . . .	22
Ceilings—	
Wood, lath and plaster. . . . .	8
Metal lath and plaster suspended. . . . .	10
Roofings—	
Wood Shingles . . . . .	3
Slate 3/16" . . . . .	7
Slate 1/4" . . . . .	10
Tile and clay shingles . . . . .	11 to 14
Roman tile, clay . . . . .	12
Spanish tile, clay . . . . .	19
Ludowici tile, Spanish . . . . .	10
Tile roof laid in mortar, add. . . . .	10
Copper (if no weight is specified) . . . . .	1 1/2
Tin . . . . .	1
Corrugated iron . . . . .	2
Tar and gravel . . . . .	6
Prepared composition . . . . .	1
	Lbs. Per
	Cu. Ft.
Sand, dry . . . . .	100
Sand, wet. . . . .	120
	Lbs. Per
	Sq. Ft.
Skylights, metal covered, wire glass . . . . .	5
	Lbs. Per
	Cu. Ft.
Steel . . . . .	490
Terra Cotta, filled with brickwork . . . . .	120
Terra Cotta, Dennison interlock tile, laid . . . . .	65
Timber—	
Fir, dry . . . . .	32
Fir, wet . . . . .	44
Oak . . . . .	46
Water, fresh at 60 degrees Fahrenheit . . . . .	62 1/2

**Refer to Sec. 2302.** The live loads specified herein are intended to include a sufficient allowance to cover the effect of impact. In the case of special occupancies involving unusual impacts provision should be made by increasing the loads herein specified.

The view has been expressed that buildings designed for low live loads will be too flexible and that vibration due to dynamic loads, particularly in theater balconies and similar places, may seriously alarm the occupants. Several cases are reported of buildings which have required alterations for this reason. There is no evidence, however, that vibration indicates dangerous conditions. A well-built structure may be flexible; and the absence of vibration does not necessarily prove that a building is safe. Two structures may be equal in strength, but may differ in stiffness, particularly if one is of cantilever type.

When it is desirable for any reason to avoid vibration or undue deflection, care should be taken to that end by designing for greater live loads or by using more braces. Safety considerations, however, on which code requirements are based, do not justify live-load assumptions greater than those given herein.

**Refer to Sec. 2311.** The following provisions are suggested for inclusion in the Code by cities located within an area subject to earthquake shocks. The design of buildings for earthquake shocks is a moot question but the following provisions will provide adequate additional strength when applied in the design of buildings or structures.

#### **Sec. 2311 (a) LATERAL BRACING.**

Every building and every portion thereof, except Type IV and V buildings and all one story buildings which are less than twenty (20) feet in height shall be designed and constructed with bracing to resist the stresses produced by lateral forces as provided in this Section. The stresses shall be calculated as the effects of a force applied horizontally at each floor or roof level above the foundation, such force to be proportional to the total dead plus live load of the building above any given plane and shall be considered as concentrated at such floor or roof level. Where the design live load specified in Section 2304 for a particular building or portion thereof is fifty (50) pounds per square foot or less, such live load may be disregarded in the computation of the lateral forces required by this Section. The full value of all live loads specified in Section 2304 more than fifty (50) pounds per square foot shall be used in such computation. The force shall be assumed to come from a direction at right angles to any elevation of the building.

All bracing systems shall be located symmetrically about the center of mass of the building and shall be of sufficient extent and detail to safely move the whole mass of the building. No system can be used which provides only for a small assumed movement of the foundation, or for only a small assumed amplitude of vibration or movement. The stresses to be provided for must be those which would be produced if the structure were subject to an unlimited translation under the shear specified in paragraphs one and two of this Section.

The factors to be employed to fix the lateral force shall vary with the character of the foundation material and shall be as follows:

1. When the foundation rests upon material upon which a load of two (2) or more tons per square foot is allowed, the horizontal force to be applied at any plane shall be assumed as seven and one-half per cent (7½%) of the total dead load plus the live load of the building above that plane.

2. When the foundation rests upon material upon which a load of less than two (2) tons per square foot is allowed, the horizontal force to be applied at any plane shall be assumed as ten per cent (10%) of the total dead load plus the live load of the building above that plane. All buildings on pile foundations shall be included in this class.

Where the design of a Type I or II building includes isolated footings, such footings shall be completely interconnected in two directions approximately at right angles to each other. Each such interconnecting member shall be capable of transmitting either by tension or compression the above seven and one half per cent ( $7\frac{1}{2}\%$ ) or ten per cent (10%) of vertical load of the heavier only of the two footings it connects. The minimum gross size of each such member shall be twelve inches by twelve inches ( $12'' \times 12''$ ) and shall be reinforced with not less than the minimum reinforcement specified in Section 2621.

With each set of plans filed, a brief statement of the following items shall be included:

(a) A summation of the dead and live load of the building, floor by floor, which was used in figuring the shears for which the building is designed.

(b) A brief description of the bracing system used, the manner in which the designer expects such system to act, and a clear statement of any assumptions used. Assumption as to location of all points of counterflexure in members must be stated.

(c) Sample calculation of a typical bent.

Stresses in structural steel due to earthquake forces combined with other forces shall not exceed by more than fifty per cent (50%) the allowable working stresses specified in Section 2702 and 2710, except that rivets may be stressed to fourteen thousand (14,000) pounds per square inch in tension. Tension and/or shear in brick walls and piers shall not exceed forty (40) pounds per square inch of net cross sectional area. The allowable unit shear in reinforced concrete walls eight (8) inches or more in thickness shall not exceed four hundredths (0.04) of the ultimate compressive strength of the concrete. Stresses in all other materials shall not exceed by more than thirty-three and one-third per cent ( $33\frac{1}{3}\%$ ) the allowable working stresses permitted in this Code.

**(b) BONDING AND TYING.**

All buildings shall be firmly bonded and tied together as to their parts and each one as a whole in such manner that the structure will act as a unit.

All veneer finish, cornices and ornamental details shall be bonded in the structure so as to form an integral part of it. This applies to the interior as well as to the exterior of the building.

Bearing walls and other walls of unit masonry construction shall be tied together at the level of each floor line from outside to outside of the structure by continuous iron rods or other bonds of continuous strength and they shall be tied to all vertical partition walls wherever practicable.

**Refer to Sec. 2511.** The following provisions are recommended for inclusion in the Code in territories subject to termite attack. These recommendations have been made by Dr. T. E. Snyder, Entomologist, Bureau of Entomology, U.S. Department of Agriculture.

**Sec. 2511.** (a) Timber to be used in contact with the earth shall be thoroughly impregnated by a standard pressure process with coal tar creosote.

sote or other approved preservative except as provided in Section 2204 (2). Timber should be completely framed before treatment whenever possible, but when cutting after treatment is unavoidable, the cut surfaces shall be thoroughly coated with coal tar creosote or other approved preservative.

(b) Wood not impregnated with an approved preservative shall not be placed in contact with the earth or within twelve (12) inches thereof, excepting posts over a concrete floor as provided in Section 2505 (a) and, in certain minor buildings, as provided in Section 2204 (2).

(c) Masonry foundations and footings shall be laid in Portland cement mortar. Foundations built up of masonry units, whether hollow or solid, shall be capped below woodwork with at least one (1) inch of Portland cement mortar, cement and slate or other approved seal.

(d) In cities where buildings are subject to termite attack a termite shield shall be provided, continuing completely around the surface of the foundation below the woodwork of the building on both the inside and outside surfaces. Such shield may be formed of a strip of non-corrodable metal firmly inserted in the surface of the masonry, or between the foundation and the wood, with the projecting edge bent downward at an angle of forty-five (45) degrees, and extending horizontally at least two (2) inches from the face of the foundation.

(e) Floor sleepers or joists, embedded in masonry or concrete or laid on concrete which is in contact with the earth, shall be impregnated with an approved preservative.

(f) Untreated wooden posts or columns supported by concrete floors must rest upon a metal or concrete footing projecting at least two (2) inches above the finished floor.

**Refer to Sec. 2601.** The requirements in Chapter 26 are based upon the recommendations of the "Joint Committee." The water-cement ratio method of proportioning concrete as outlined in Section 2606 is based upon a wide range of tests and experiences and has been found to be the best method of proportioning concrete. It should be noted, however, that the actual strength of the concrete is the ultimate measure to be used in design.

**Refer to Sec. 2701.** The requirements for steel construction incorporated in Chapter 27 follow the recommended practice of the American Institute of Steel Construction.

The inspection and tests noted in Section 2701 should not necessarily be required where the mill tests of the steel may be readily obtained.

**Refer to Sec. 4602.** The following list includes all of the documents included in the Uniform Building Code in the order in which they occur:

1. Suggested Ordinance Regulating the Use, Handling, Storage and Sale of Flammable Liquids and the Products Thereof, adopted by the National Fire Protection Association, May, 1926.
2. Standard Specifications for Tests of Brick, Serial Designation C21-20 of the American Society for Testing Materials.
3. Tentative Specifications for Concrete Building Brick, Serial Designation C-55-24T of the American Society for Testing Materials.

4. Standard Specifications for Tests of Concrete Block or Tile, Serial Designation P-1A-26T of the American Concrete Institute.
5. Standard Specifications for Gypsum Partition Tile and Block, Serial Designations C52-25 of the American Society for Testing Materials.
6. Standard Specifications for Gypsum and Calcined Gypsum, Serial Designations C22-25 and C23-22, respectively, of the American Society for Testing Materials.
7. Standard Specifications and Tests for Hollow Burned-Clay Load-Bearing Wall Tile, Serial Designation C34-26 of the American Society for Testing Materials.
8. Standard Specifications for Quicklime for Structural Purposes, Serial Designation C5-26 of the American Society for Testing Materials.
9. Standard Specifications for Hydrated Lime for Structural Purposes, Serial Designation C6-24 of the American Society for Testing Materials.
10. Standard Specifications for Tests of Portland Cement, Serial Designation C9-26 of the American Society for Testing Materials.
11. Report of the Joint Committee for Concrete and Reinforced Concrete as of August, 1924.
12. Basic provisions of American Lumber Standards for Structural Materials, published by the Bureau of Standards, Department of Commerce, July, 1926.
13. Standard Specifications for Billet-Steel Concrete Reinforcement Bars of Structural, Intermediate or Hard Grade, Serial Designation A15-14 of the American Society for Testing Materials.
14. Standard Specifications for Rail Steel Concrete Reinforcement Bars, Serial Designation A16-14 of the American Society for Testing Materials.
15. Tentative Specifications for Cold-Drawn Steel Wire for Concrete Reinforcement, Serial Designation A82-21T of the American Society for Testing Materials.
16. Standard Methods of Making and Storing Specimens of Concrete in the Field, Serial Designation C31-21 of the American Society for Testing Materials.
17. Standard Methods of Making Compression Tests of Concrete, Serial Designation C39-25 of the American Society for Testing Materials.
18. Standard Specifications for Structural Steel for Buildings, Serial Designation A9-24 of the American Society for Testing Materials.
19. Standard Specifications for Steel Castings, Serial Designation A27-24 of the American Society for Testing Materials.
20. Standard Specifications for Gray Iron Castings, Serial Designation A48-18 of the American Society for Testing Materials.
21. American Welding Society Bulletin No. 2, published December, 1921.

22. A Standard Ordinance for Chimney Construction Recommended by the National Board of Fire Underwriters, Third Edition, Revised 1927.

23. Regulations for the Construction and Installation of Oil Burning Equipments and for the Storage and Use of Oil Fuels in Connection Therewith, Recommended by the National Fire Protection Association, Edition of 1925.

24. Regulations for the Installation of Sprinkler Equipments, Recommended by the National Fire Protection Association, Edition of 1925.

25. Safety Code for Elevators of the American Engineering Standards Committee, published July, 1925.

26. Tentative Specifications for Fire Tests of Building Construction and Materials, Serial Designation C19-26T of the American Society for Testing Materials.

27. Underwriters' Standard for Tin-Clad Fire Doors and Shutters, Edition of March, 1926.

28. Regulations of the National Board of Fire Underwriters for the Protection of Openings in Walls and Partitions Against Fire, Recommended by the National Fire Protection Association, Edition of 1927.

#### **Suggestions for Inspectors.**

1. Remember always that you represent the City. A city is made up of all the people living therein and your actions should be governed accordingly.

2. Be particular at the beginning of a job. An erroneous method is more easily corrected the first time it is practiced than after it has been in use. The reputation of being slack or "easy," though it may be attained in a few days, is hard to overcome.

3. Be friendly with everyone on the job, but familiar with no one. Familiarity dulls the edge of the Inspector's authority.

4. Give orders to foremen, superintendents or contractor only. That rule does not apply to things of minor importance, such as the correction of form alignment, dirt in the bottom of forms for concrete, or other routine every-day occurrences. In such things it is proper for the Inspector to call the defect to the attention of the workmen responsible for that particular part of the job.

5. Do not waste workmen's time by talking to them.

6. Don't argue. Refer disputed questions to the Chief Inspector, and, until you have an answer from him, use your own judgment. Be sure that your judgement is so cool, fair and impartial and your knowledge of the work so thorough, that you command respect and obedience.

7. Do not try to magnify your own importance by telling outsiders of the errors you have corrected or the "crooked work" you have uncovered. The quality of the completed product will measure your ability.

8. Realize the importance of your work. The lives of many people are dependent in a large measure on the faithful performances of your duty. Consider your duties seriously and others will do likewise.





# INDEX

**NOTE: 1.** The following abbreviations are used in this index:

- A. S. T. M.—American Society for Testing Materials
- A. E. S. C.—American Engineering Standards Committee
- A. W. S.—American Welding Society
- A. C. I.—American Concrete Institute
- A. L. S.—American Lumber Standards published by Bureau of Standards, July, 1926
- J. C.—Joint Committee on Reinforced Concrete
- N. B. F. U.—National Board of Fire Underwriters
- N. F. P. A.—National Fire Protection Association
- Und. Lab.—Underwriters Laboratories, Inc.

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